AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

OCTOBER, 1958

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Precision Metal Molding

PMM

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS

EXTRUSIONS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

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Only an aluminum investment casting made this test [illegible] Gordon Engwersen, Materials Engineer, [illegible] Honeywell. See page [illegible].

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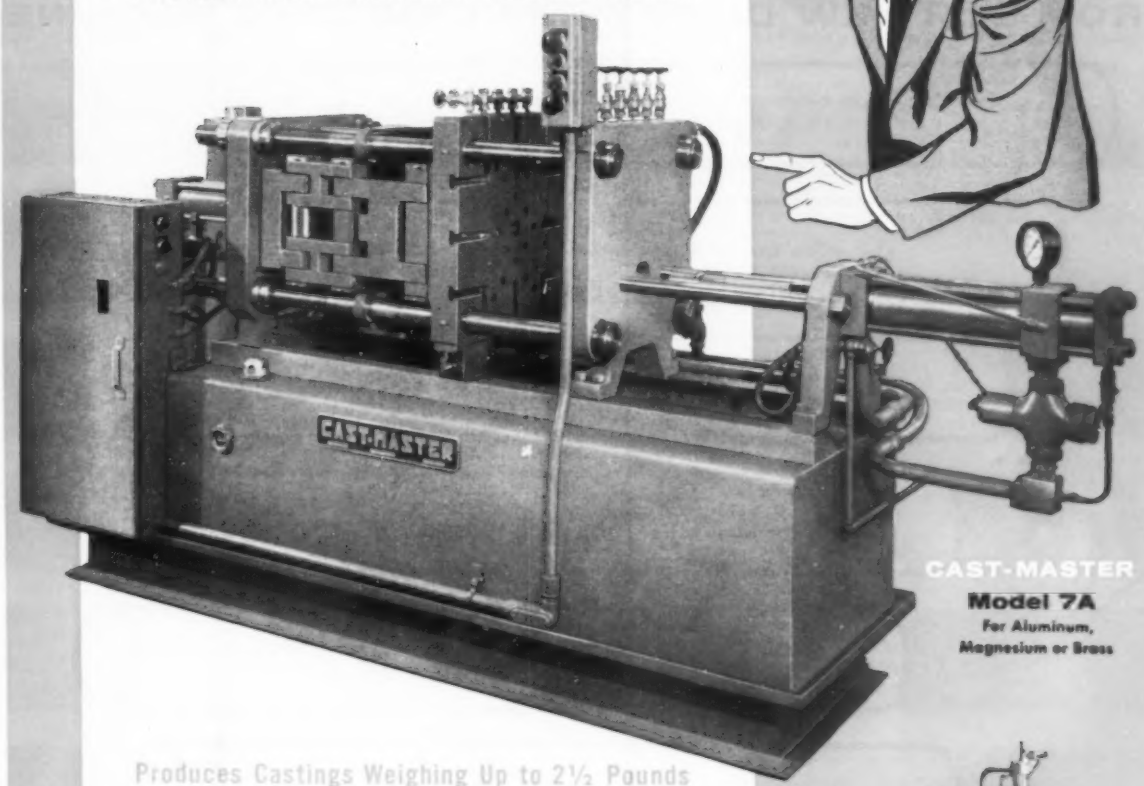

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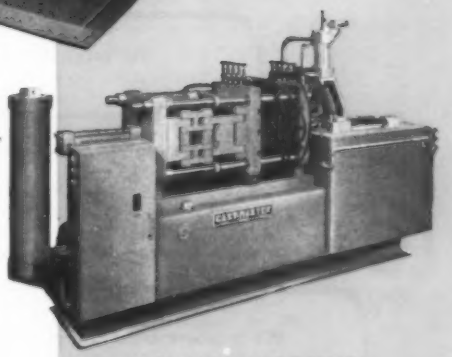

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IN THIS ISSUE

October 1958: Volume 16 Number 10

COVER

ROUGH SERVICE REQUIREMENTS plus intricate shape can be a headache for any product designer and materials engineer. These were the conditions faced by Jim Heldenbrand (extreme left) and Gordon Ingwersen (extreme right) when they had to design and produce a part of the fuel measuring system developed by Minneapolis-Honeywell Regulator Co. for the DC-8 aircraft. How they solved their problem with an aluminum investment casting is told on page 35.

FEATURE ARTICLES

35 **CHANGE TO INVESTMENT CAST ALUMINUM**
To secure pressure tightness, high strength, resistance to corrosion and take vibration was solved by an aluminum investment casting.

36 **YOU GET BETTER BEZELS WITH ZINC DIE CASTINGS**
A manufacturer of vending machines was faced with the problem of an attractive bezel that had to be dimensionally accurate, flat, and with good surface. Die castings were the answer.

37 **THE EXTRUSION PROCESS**
Because intelligent application of any part is easier if the designer knows something about the manufacturing process used, here's a thumb-nail sketch of the extrusion process.

40 **IMPACT EXTRUSION OF STEEL WRIST PINS**
Instead of machining heavy walled welded tubing, Ford Motor Co. engineers found impact extrusion better and cheaper. Here are the details of how the wrist pins are made.

44 **DESIGNING FOR EXTRUSIONS**
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48 **CUT THOSE EXPENSIVE MOLD AND DIE TOOLING COSTS**
Through the use of special electrical spark discharge equipment, precise cavities can be formed in the hardest metals.

50 **INVESTMENT CASTINGS FOR JET ENGINE STARTERS**
Complex shapes, high stresses and high temperatures all combine to make these parts a production engineers headache. Investment castings were the answer.

52 **REALISTIC TOLERANCES FOR SINTERINGS**
When you design for sinterings specify what you really need. The part will be better and the costs much lower.

54 **DESIGN PROPERTIES OF SINTERINGS Part I — Non ferrous alloys.**
Finally the producers of sinterings are listing design properties that can be used safely. More will come as reliable data are collected.

57 **THE OUTLOOK FOR ZINC**
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58 **SECONDARY ALUMINUM FOR DIE CASTING**
A prominent producer of secondary aluminum looks at the market for aluminum die castings.

59 **PRIMARY ALUMINUM FOR DIE CASTING**
With greatly increased productive capacity and with more capacity being added, the primary aluminum industry has plenty of metal for all uses.

60 **CLEVER EXTRUSIONS CUTS MANUFACTURER'S COSTS**
Because extrusion dies are inexpensive and the custom extruder can make short runs, even a small manufacturer can benefit from the economy of extrusions.

61 **ADVANTAGES OF SYNTHETIC HYDRAULIC FLUIDS**
In addition to their fire-resistance, synthetic hydraulic fluids have excellent lubricating properties. Here's some service results on one fluid.

62 **INTERIM REPORT ON VACUUM DIE CASTING**
Here's one of the first reports on the advantages and the disadvantages of vacuum die casting as reported by a commercial foundry.

65 **DESIGN TIPS**
Proper dimensioning of extrusion drawings makes the job of die making, extrusion and inspection easier.

FINISHING SECTION

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72 **JOB SHOP PAINTING OF DIE CASTINGS**
The job shop must be ready for any sort of a painting job. Here's how to get the most flexibility at the lowest cost.

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4 more cost-cutting examples of PE ALUMINUM Extrusioneering

Here are more examples of P-E Aluminum Extrusioneering. All angles, flutes and varying thicknesses required for each piece are produced in a single operation without machining. Each design offers inherent advantages of greater strength in less weight and the plus benefits of a durable, non-corrosive finish. As indicated, the experience of P-E engineers provides invaluable aid in the functional design of extruded shapes which effect substantial savings in manufacturing costs.

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Mill run shapes available without die charge in a wide range of rod, bar, and tubing sizes, and numerous shapes.

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We produce extrusions only, do not fabricate or manufacture any other product. You get experienced, confidential help in creating any special shape to suit your needs.

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(Above) Red-hot steel slabs, weighing over 2 tons each, are at arm's length from hydraulic lines filled with Irus Fluid 902—YET NO FIRE HAZARD.

(Right) The distinctive yellow color of Irus Fluid makes it easy to spot and trace hydraulic line leaks.

"After numerous tests, we selected Shell Irus Fluid 902 because of its excellent fire resistance and low cost,"

says Norman Bracht, Lubrication Engineer, Alan Wood Steel Company, Conshohocken, Pa.

A fire in the strip mill, causing serious equipment damage and plant down time, convinced the Alan Wood Steel Company that a switchover to a fire-resistant hydraulic fluid was imperative. After extensive testing with various commercial types, Shell Irus Fluid 902 was selected. Now . . . twelve months later . . . Alan Wood is convinced that serious hydraulic fires in strip mill tilt table are a thing of the past.

Irus* Fluid 902 is a specially compounded water-in-oil emulsion which has exceptional fire resistance. Plant tests show, time after time, that Irus Fluid 902 *actually snuffs out fire!*

Many plant operators, like Alan Wood Steel, have discovered that Irus Fluid is economical . . . costing up to one-third less than other fire-resistant fluids, yet its performance is comparable in every practical respect.

If your present hydraulic equipment is vulnerable to accidental fire hazard, we suggest that you obtain complete technical information on Shell Irus Fluid 902. Write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y. or 100 Bush Street, San Francisco 6, California.

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SHELL IRUS FLUID 902

a low-cost, fire-resistant hydraulic fluid

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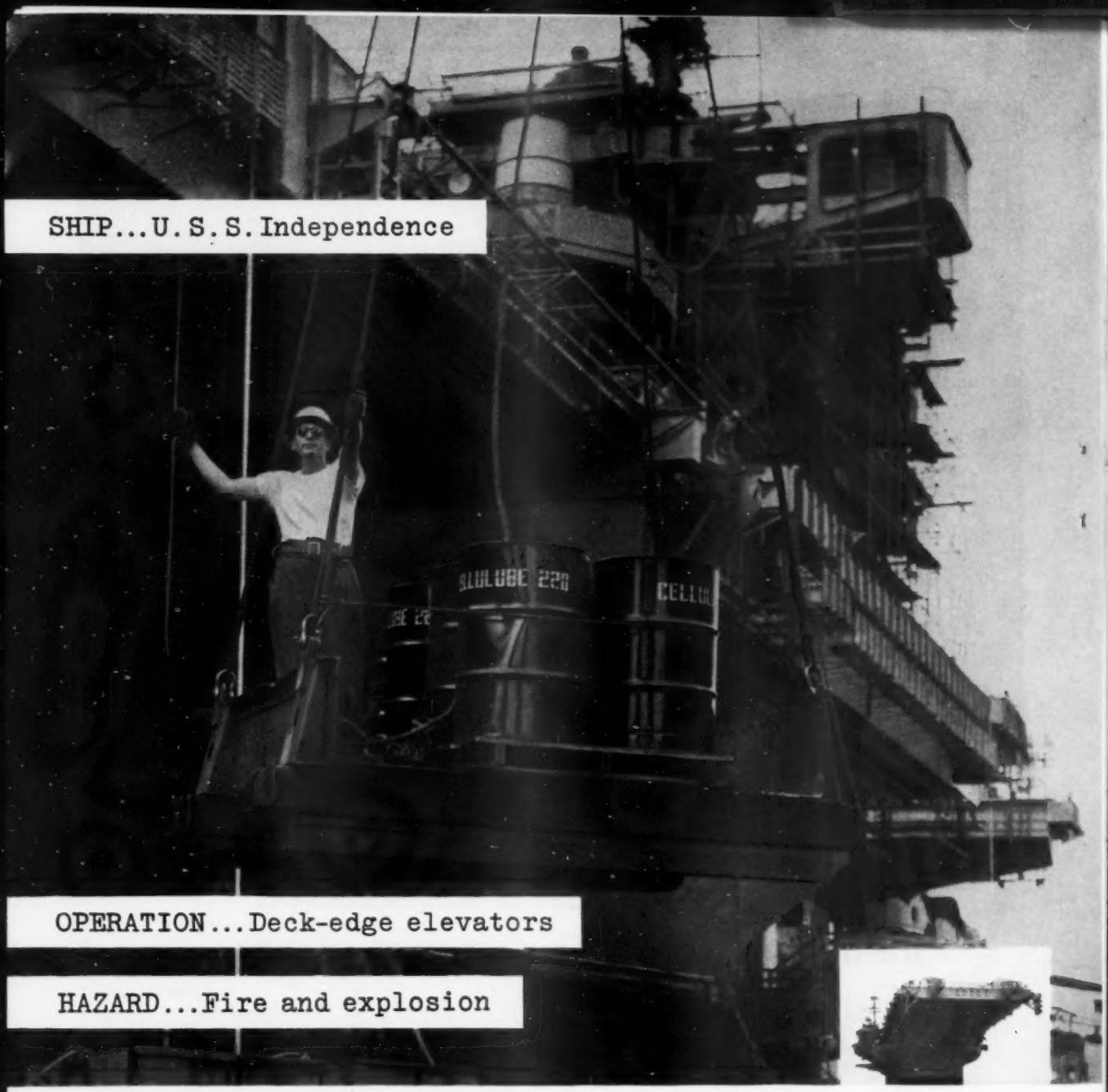

Hydraulic Fluid Used...FIRE-RESISTANT CELLULUBES

Fifty-five gallon drums of Cellulube . . . part of a six-car train load . . . being put aboard the Independence to operate deck-edge elevators between hangar and flight decks.

The U. S. S. Independence, newest Navy supercarrier, recently christened and soon to be commissioned.

Thousands of gallons of Celanese Cellulubes . . . fire-resistant hydraulic fluids . . . have been loaded aboard the U.S.S. Independence, the Navy's newest 60,000-ton supercarrier. In fact, *all* of the ships in the Navy's great carrier fleet carry Cellulubes in the hydraulic systems of their deck-edge elevators . . . and on the mighty missile ships, atomic-powered submarine and destroyers, too, these functional fluids are doing their fire-safe hydraulic duty.

The Navy has long used Cellulubes, and industry, too, of course, has long depended on these outstanding hydraulic fluids . . . for power transfer and lubrication where sure resistance to flame and explosion, excellent lubricity, and unchanging viscosity are important. Cellulubes are available in six controlled viscosities, one of which is best suited to your particular operations and the safety of your plant. For evaluation samples, please let us know the application involved. Celanese Corporation of America, Chemical Division, Dept. 58-J. 180 Madison Avenue, New York 16, N. Y.

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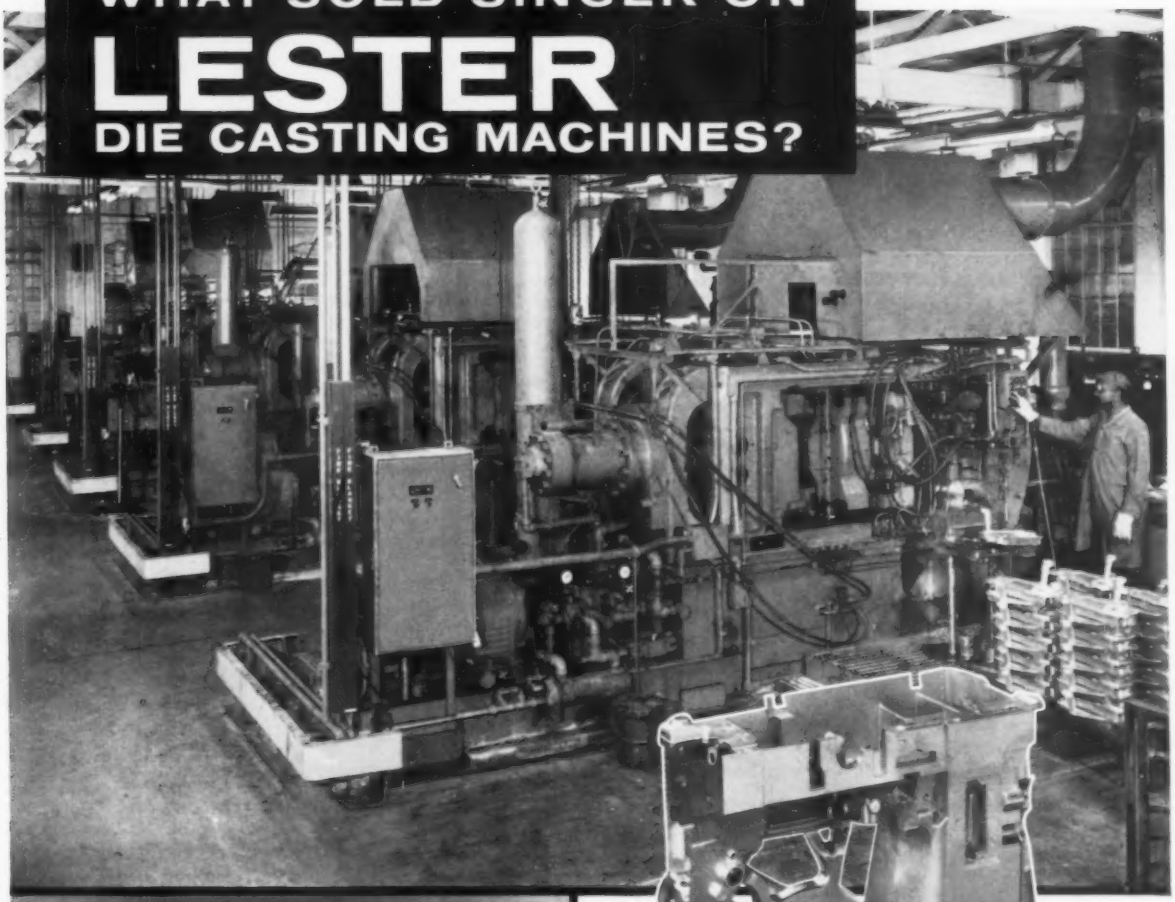
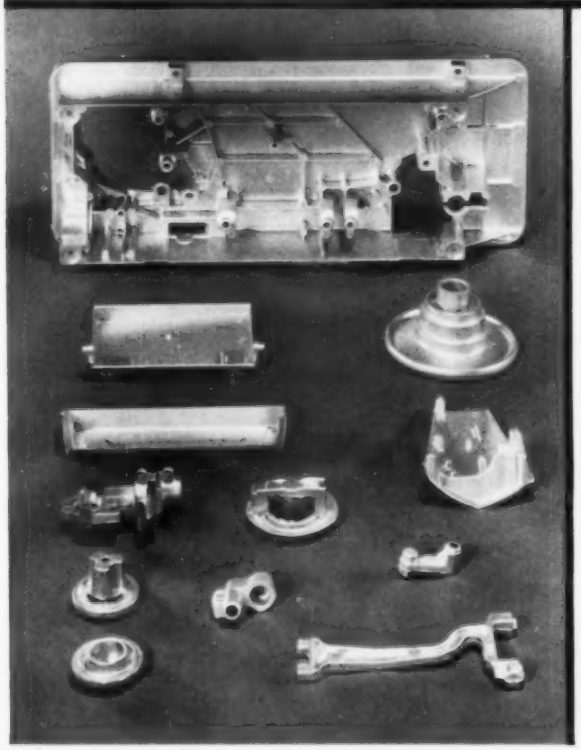
WHAT SOLD SINGER ON LESTER DIE CASTING MACHINES?





6¼ lb. aluminum arm unit, cast on 800 ton Lester at Singer. Other SINGER parts, all cast on Lesters, shown at left.

What sold SINGER on Lesters? The basic rigidity of the one-piece frame which can be depended upon to tightly lock and keep locked even the largest of their dies, the main arm unit for their new model #401 SLANT-O-MATIC Sewing Machine. With this dependable clamp, they obtain consistent production of quality castings, with finish and density they have been otherwise unable to obtain.

As a result, Singer has installed 15 Lester Die Casting Machines of 800 ton and 600 ton capacity in their plant in Elizabethport, New Jersey.

Detailed information on Lester Die Casting Machines is available by writing...

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CASTING ABOUT

technical news of applications
& processes involving precision metal moldings

INCREASED ALUMINA PRODUCTION will result from the formation of a new international corporation. The companies involved in the new organization are Olin Mathieson Chemical Corp. with 53½% of the stock, Pechiney Compagnie de Produits Chimiques et Electrometallurgiques and Societe d'Electrochimie, d'Electrometallurgie et des Acieries Electriques d'Ugine with 26½% of the stock, Aluminum Industrie Aktiengesellschaft with 10%, and The British Aluminium Co., Ltd. with 10%. The new company, known as FRIA will develop the vast bauxite deposits in French Guinea. The French West African bauxite deposit is one of the world's largest. Cost of the development is estimated at $135,000,000. Initial operation will be by Pechiney at a rate of 480,000 tons per year, with possible expansion to 1,200,000 tons per year. Alumina purchases will be in proportion to percentage of ownership.

SUPER-STRENGTH TITANIUM SHEET is now being marketed by Titanium Metals Corp. The new alloy is Ti-4A1-3Mo-1V. It is heat-treatable to average tensile strengths of 190,000 psi, 50% stronger than the best alloy available five years ago. Initial shipments of the alloy went to west coast aircraft researchers for use in a manned aircraft to fly at Mach 3 (2100 miles per hour). At these speeds the pressures developed on the metal are around 100 tons per sq. in. and temperatures may be as high as 600°F.

VACUUM METALLURGY RESEARCH FACILITIES for companies who want to do limited investigation have been made available by the F. J. Stokes Corp. According to the comapny this is the first custom-research facility in the field of vacuum metallurgy to be established. The new laboratory will be equipped with an induction melting furnace with a crucible capacity of 17 pounds capable of handling ingots up to 15 in. high by 10 in. in diameter. The laboratory facilities will be available at very nominal cost.

MINERAL PRODUCTION IN CANADA may triple in the next 25 years a recent survey showed. While this seems to be a bright outlook the report also showed that there may be some unfavorable features. Price drops, increased tariffs, unrealistic pricing and foreign domination of the producing companies are some of the soft spots. The report shows possible increases by 1980 as – Iron ore 85,000,000 tons from 14,600,000 tons in 1955; nickel 325,000 tons from 175,000 tons; copper 550,000 tons from 325,000 tons; zinc 800,000 tons from 427,000 tons; lead 320,000 tons from 203,000 tons; and aluminum 2,400,000 tons from 584,000 tons. The report which covers many other minerals currently being produced in Canada was issued by Dr. John Davis for the Royal Commission on Economic Prospects.

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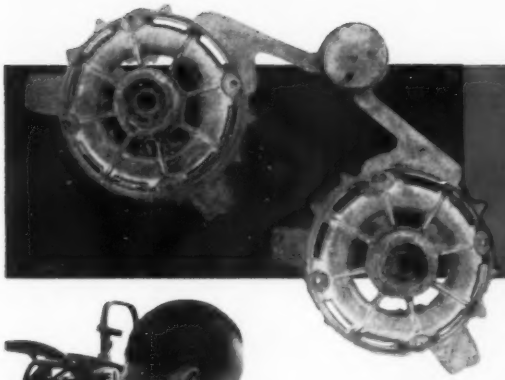
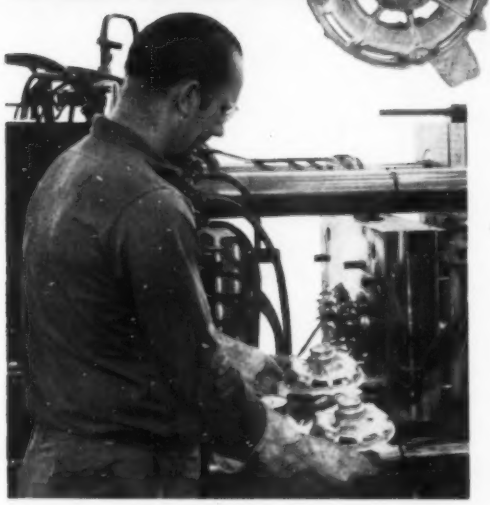


to die cast aluminum motor end-bells . . .



ABOVE: Operator removing end-bell casting from one of Emerson-Electric's new Model 400-N Clevelands. End-bell is 6¼" in dia. Weight of shot approx. 2½ lbs. A close-up view of the "as-cast" part is also shown.

BELOW: Cleveland Model 400-N with aluminum shot end. Also available as a hot chamber, zinc machine. Has 36"x40" die plates; 400-tons locking pressure, **strain gage tested.**

EMERSON-ELECTRIC AGAIN SELECTS MODEL 400-N

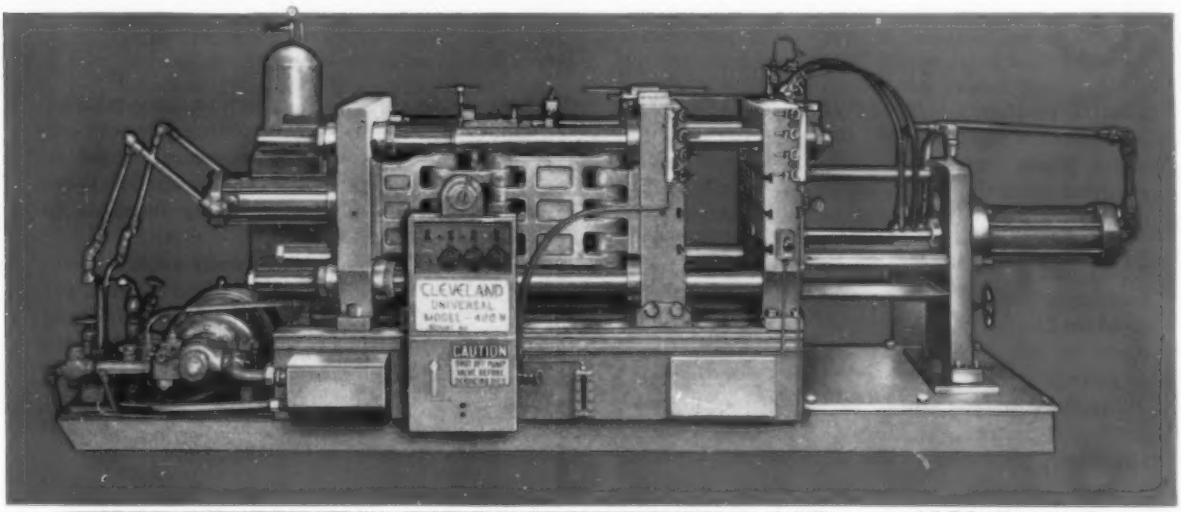
CLEVELANDS

The Emerson Electric Mfg. Co., manufacturer of Emerson-Electric motors and appliances, operates two Model 400-N Clevelands in their St. Louis plant, to cast aluminum motor end-bells.

Based on the excellent performance of these Clevelands, Emerson-Electric has recently installed *two more* Model 400-N Clevelands in their new, modern plant at Paragould, Ark. These new Clevelands are also producing aluminum end-bells in two-cavity dies.

For the Paragould installation, the new Model 400-N's were built as "right-hand" and "left-hand" machines; are located shot end-to-shot end. One operator controls both machines, ladling from a central furnace.

The nation's leading producers of die castings rely on *Clevelands* for dependable, profitable performance. Investigate their advantages for *your* production. Built in 50, 200, 400 and 600 ton capacities, for zinc and aluminum casting. For machine specifications, write for new Bulletin No. 5246.



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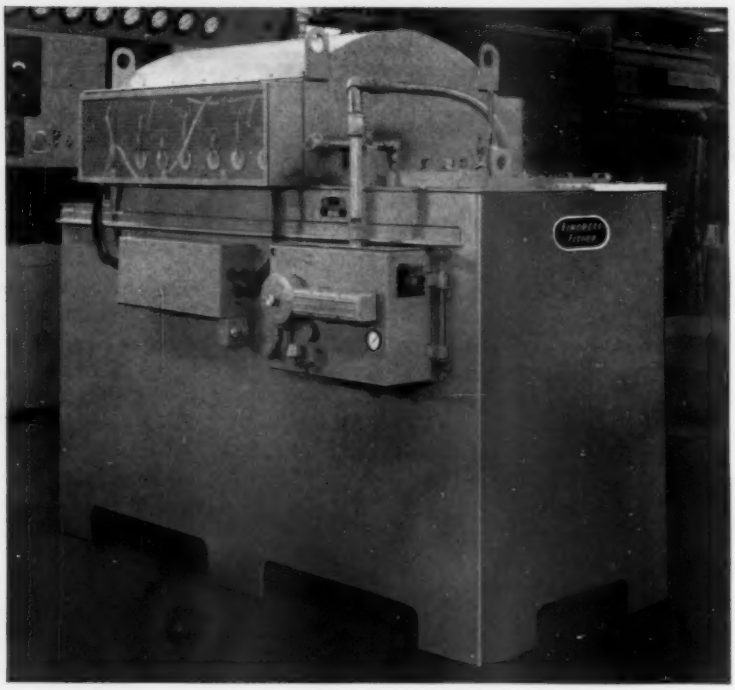
There's a Lindberg Aluminum Holding Furnace Just Right for Your Specific Job



This is Little Joe, the Lindberg Autoladle, the first practical automatic aluminum ladling unit yet devised. An exclusive feature of Lindberg electric resistance holding furnaces, "Little Joe" makes automatic casting of aluminum fast, dependable and economical.

Electric resistance holding furnaces for aluminum have been a specialty of Lindberg engineers for years. These furnaces have proved themselves in superior operation in varied industries, the world over. Now Lindberg offers a complete line, newly-designed, available in capacities of 1,000, 1,500, 2,000, and 3,500 lbs. If your production processes require proper holding of aluminum you can depend on Lindberg to provide just the right equipment for the most efficient and practical answer to your problems.

Lindberg makes a wide variety of melting and holding furnaces for aluminum, brass, bronze, tin, zinc, lead and other non-ferrous metals. These include aluminum induction, nose-pouring crucibles, electric resistance holding furnaces and big reverbs. For foundry, permanent mold or die-casting plant, independent or captive, there are Lindberg melting and holding furnaces to fit every need.

If your problem in this field needs a special solution Lindberg's design staff can find it. Just get in touch with the Lindberg plant or the Lindberg Field Representative in your locality, or write Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California.

LINDBERG heat for industry

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Die Castings Cut 10 Pounds off Frameweight of New Royal Standard

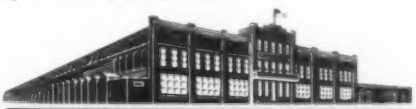
CASE HISTORIES FROM MT. VERNON FILES

"Never before has a standard typewriter featured so many new improvements. From Twin-Pak to Touch, this new Royal Standard opens up a whole new world of breathtaking ease and economy." It is a fine example of beautiful design, excellent engineering and wise choice of materials.

Because of the remarkable strides made by the die casting industry in the production of sound economical aluminum die castings, the major portion of the framework of all the Royal Typewriters are die cast. Through the use of aluminum die castings having cored holes, close tolerances and thin walls ribbed for maximum strength, Royal engineers have reduced the weight of the framework of the Standard model from 15 pounds to approximately 5 pounds . . . an impressive savings of 10 pounds.

All told, the Royal McBee Corporation uses from 2½ to 3 million pounds of aluminum die castings yearly and the end of die casting usage is not in sight. Royal engineers are constantly alert to additional die casting applications because of the tremendous savings in man and machine hours which are achieved through the elimination of costly secondary operations.

A switch to die casting may be *your* next step. It will be well worth your time to bring your product specifications to Mt. Vernon, for ours is a complete, four-fold service of 1. Consultation 2. Die making 3. Die casting 4. and Machining facilities all under one roof occupying 200,000 square feet of space . . . For quick action, contact your nearest sales representative listed below.



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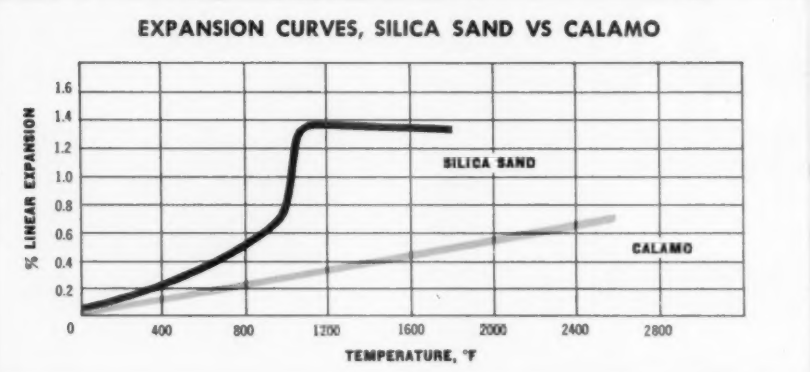
Harbison-Walker

REFRACTORY MOLD MATERIALS

for metal casting



Calamo for Investment Molds

CALAMO, one of the extensively used Harbison-Walker products for molding is an alumina-silica refractory of optimum sizings for various molding mixtures. Its fusion point is 100°F. higher than that of normal silica sand mixes.

The chart above shows the exceedingly desirable expansion curve of CALAMO as compared with that of silica sand.

CALAMO, used as the major constituent of precision casting investment mixes, improves the dimensional constancy of the molds, makes them stronger and more resistant to erosion by metal flow. Investment costs are measurably reduced because an appreciably lesser amount of bonding agent is needed. This is attributable to the very desirable particle sizing and the equiaxed, dense grains of CALAMO.

CALAMO, used alone or as the major part of conventional dry sand molding mixes in rammed or in slinger-placed sand molds, provides not only the very desirable low thermal expansion characteristics particularly suited for precision casting but also provides the required refractoriness for metals and alloys which are melted at unusually high temperatures.

H-W Forsterite Grains for Shell Molds

Forsterite grain is highly refractory magnesium silicate possessing physical properties which make it especially suited for resin-bonded shell molding. Its specific heat, thermal conductivity, high temperature stability and uniform thermal expansion —all contribute to its excellent performance.

As the result of the optimum chilling effect of forsterite grain, sufficient strength develops in the skin of the steel casting to resist outside gas pressure as well as inside ferrostatic pressure, and a smooth casting surface is assured.

H-W FORSTERITE GRAINS are supplied in controlled sizings best suited for securing the most satisfactory shell molded casting surfaces.

H-W FORSTERITE FLOUR is furnished for use as an additive to the H-W FORSTERITE GRAINS and resin mix to provide for the ultimate in surface smoothness, particularly of castings with heavy sections.

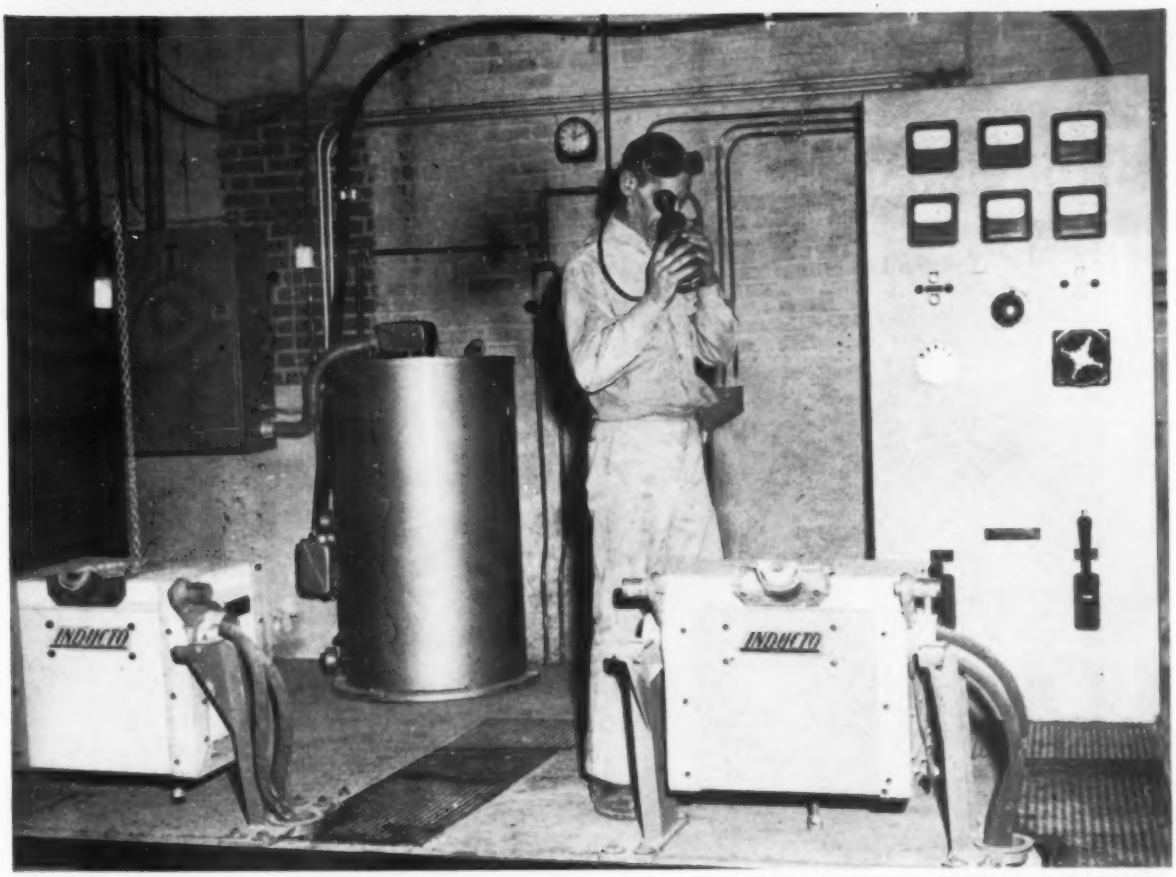
Write us for information regarding these and other Harbison-Walker products —mold wash materials—ceramic molding media—mold sand bonding clays.

HARBISON-WALKER REFRACTORIES COMPANY
AND SUBSIDIARIES
GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

For more information circle No. 34 on the Reader Service Card

ANOTHER INDUCTO INSTALLATION...



COURTESY OF CONNECTICUT INVESTMENT CASTING CORP.

Connecticut Investment Casting Gets Accurate Heat Control In Every Melt With INDUCTO Furnaces

When melting steel alloys for precision casting, precise temperature control is an important factor. Of course, controllable analysis of the alloys in heat after heat, homogeniety of each melt and high melting speeds are important, too! That is why Connecticut Investment Casting Corporation selected INDUCTO furnaces for the job.

INDUCTO high-frequency induction furnaces and controls have proven ideal for precision casting methods. For in addition to fast, clean, accurate melting, they are compact, efficient and designed for long, maintenance-free service.

The furnaces have sturdy welded frames which minimize distortion and assure longer lining life. The water-cooled leads enter the furnace through the trunnion thereby reducing the twisting and flexing which shorten lead life.

The control is compact and easy to operate. Furnace selector switches are conveniently mounted on the front of the panel. The control is shipped completely assembled and ready for installation.

For more complete details, write for Bulletin 70. Inductotherm Corporation, 412 Illinois Avenue, Delanco, N. J.

INDUCTOTHERM CORPORATION
INDUCTO

INDUCTOTHERM
corporation

For more information circle No. 41 on the Reader Service Card

Wind Shield for 120 mm Shells Die-Cast with Cromo-High V

Each piece has to be virtually perfect when you're die-casting aluminum wind shields for 120 mm shells. Tooling up for a job like this calls for tool steel that will not only turn out high-quality castings, but will also keep production costs low.

Bethlehem has several grades of hot-work tool steel which could be considered for such a highly specialized application. The die caster weighed all the facts with Bethlehem's local tool steel distributor. Together, they came up with an excellent tool steel for jobs of this sort—Cromo-High V.

Cromo-High V, our 5 pct chrome-moly tool steel with 1 pct vanadium, is ideal for die-casting zinc, aluminum or magnesium because of its great stamina, and resistance to wash and erosion. Cromo-High V is made by a controlled melting procedure. It is uniformly annealed, easy to machine, and has good center density and grain refinement. It is also free from porosity. Cromo-High V is ultrasonic-tested for quality, responds uniformly to heat-treatment, and can be heat-treated in massive sections to a uniform hardness of Rockwell C45-47.

In addition to Cromo-High V, Bethlehem makes these other tool steels for die-casters: Cromo-V (chrome-moly-vanadium), Cromo-W (chrome-moly-tungsten), and Cromo-WV (chrome-moly-tungsten-vanadium). For full details, get in touch with your Bethlehem tool steel distributor.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM TOOL STEELS

For more information circle No. 16 on the Reader Service Card

LETTERS

the readers' forum

MORE ON "TENS-50"

We are regular readers of your magazine and are interested in the feature article on page 21 of the August '58 issue.

If possible, we should like to obtain further and fuller information on the composition of the alloy mentioned under the trade name of "Tens-50."—J.H., Managing Dir. (England)

Tens-50 is an aluminum casting alloy containing small amounts of beryllium as the age hardening agent. Full details about this alloy can be obtained from North American Aviation Corp., International Airport, Los Angeles, Calif.—ed.

We note with great interest the article discussing the high strength aluminum casting alloy, Tens-50 used for aluminum sand and permanent mold castings.

At your earliest convenience, we would very much appreciate your sending us 24 reprints of this article.—S. McC., Jr.

BORIDE COATINGS

In your October, 1957 issue of PRECISION METAL MOLDING there was an article mentioning a newly developed chromium boride spray for surfacing steel and cast iron parts to prevent attack by molten aluminum. Would you be kind enough to supply us with a source for this material and equipment or a source which can handle our requirements on a per piece basis.—J. M. E.

The boride coating referred to in the article was a development of the Metalizing Co. of America, Chicago, Ill.—ed.

GRIP RINGS

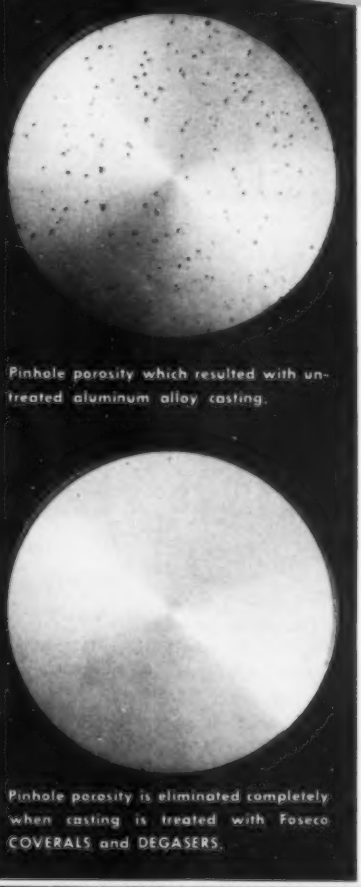
We would be pleased to receive the address of Walds Kohinoor, Inc., manufacturers of grip rings described on page 57 of the August, 1957 issue of PMM.—J. M. T.

The address of Walds Kohinoor, Inc. is Austil Place, Long Island City, N.Y.—ed.

continued on page 20

Foseco COVERALS AND NEW, HIGHLY EFFICIENT DEGASERS

ELIMINATE PINHOLE POROSITY AND OXIDES IN ALUMINUM CASTINGS, BILLETS AND SLABS . . .



Pinhole porosity which resulted with untreated aluminum alloy casting.

Pinhole porosity is eliminated completely when casting is treated with Foseco COVERALS and DEGASERS.

save time and materials

- Speedily remove hydrogen from all aluminum alloys
- Minimize oxidation
- Help remove dirt and non-metallics from the melt
- Produce drosses low in metal content
- Prevent oxide build-up in furnaces
- Help prevent blistering

Efficient Foseco Coverals and *new* Foseco Degasers are available for use in all types of melting furnaces, and for treating *all* aluminum alloys.

Foundry Services, Inc. maintains a continuing research and development program to create more efficient products to insure you high quality metals at a low cost. Consult us for assistance on any of your metal treatment problems. There's no obligation.

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Company_____

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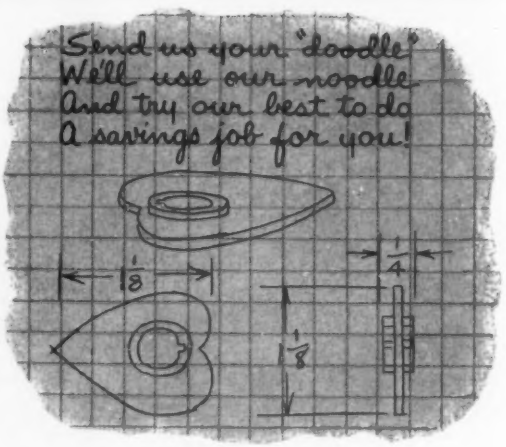
For more information circle No. 28 on the Reader Service Card

Powder metallurgy cuts parts costs up to 75% for manufacturers of products like these

Why not find out now if powder metallurgy holds the answer to your high parts costs?

Send Glidden a sketch of any part, plus the quantity desired. Glidden, with the help of qualified parts fabricators in your area, will determine, first, whether the part can be made with metal powder. If it can, you will receive cost quotations that may show really worthwhile savings—similar to savings realized by an increasing number of manufacturers who have found that metal powder parts can be mass-produced faster, better, more economically.

As a leading supplier of metal powders, Glidden works closely with parts producers. In this way, several staffs of experienced technicians may be at your disposal—to provide complete technical service and suggest possible design changes that may bring even lower parts costs.



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CUPRIC OXIDE • CUPROUS SULFIDE • CUBOND COPPER BRAZING PASTE • COPPER PIGMENT

For more information circle No. 30 on the Reader Service Card

This alloy "shopping list" saves many a day for busy metallurgists!

AISI		AMS			SAE	
302	410	5333	5376	5631	30302	51442
303	414	5334	5378	5640	30303	51446
304	416	5350	5380	5643	30303F	60303A
308	420	5351	5382	5645	30304	60304
309	430	5352	5385	5665	30310	60310
309+W	430F	5354	5386	5700	30316	60316
310	431	5355	5388	5710	30321	60347
316	431A	5358	5389	5735	30347	60410
321	436	5360	5392	5765	51410	60420
327	440A	5361	5393	6270F	51414	60442
329	440B	5362	5394	6274F	51416F	60446
330	440C	5363	5526	6280C	51420	70310
331	440F	5366	5537	6350	51430	70310A
347	442	5369	5610E	6382	51431	70327
403	446	5370	5616	6428	51440A	70330
406		5372	5621	7834	51440B	70331
		5373	5628		51440C	70446
		5375	5630		51440F	

MISCELLANEOUS

Armco 17-4PH • GMR 235 • Inconel® • Invar • Monel® • NiResist® IA
NiResist® IIA • NiResist® III • Waspalloy

®Ⓡ International Nickel Co.

You name the alloy... we'll produce to your specs. —in record time!

THE watchword of CANNON-MUSKEGON is "CONTROL." Careful selection of the finest raw materials . . . rigid melting procedures . . . complete chemical and physical testing facilities, plus closely supervised handling — produce alloys to your most exacting standards. More than 100 special and standard alloy analyses are produced each year.

The alloy list above is typical of production "regulars" for scores of users in all industrial fields. If you don't see what you need — remember, our facilities are open to "tailor" alloys to your specific needs. We'll also recommend proper in-plant handling and heat treating procedures to assure the desired physical and chemical properties in your final product.

FOR IMMEDIATE REFERENCE — write for your personal copy of Cannon-Muskegon's 6-page handbook for metallurgists, giving you data on both UltraMet and MasterMet alloy service.

CAN ULTRA MET — VACUUM-MELTED ALLOYS FOR INDUSTRY

CAN MASTER MET — CERTIFIED ALLOYS FOR INDUSTRY

and CANNON-MUSKEGON offers you both vacuum and air-melting facilities for cobalt-, ferrous- and nickel-base alloys in a wide variety of cast forms

UltraMet alloys are produced in this latest design vacuum melting furnace — production center for a virtually unlimited variety of high temperature, corrosion resistant alloys for severe-stress applications.

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METALLURGICAL SPECIALISTS

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This Dollin emblem on your die-castings assures maximum quality and economy, resulting from Dollin's advanced equipment, methods and experienced craftsmen.

Dollin is a supporting member of the American Die-Casting Institute which sponsors research to improve methods, raise standards and broaden applications of die-castings.

Dollin is a licensee of the Certified Zinc Alloy Plan, which assures conformity with industry standards of chemical control and metal purity through independent checking.

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Dollin is a participating member of the Die-Casting Research Foundation, comprising over 100 die-casting companies engaged in cooperative research to improve production techniques and equipment.

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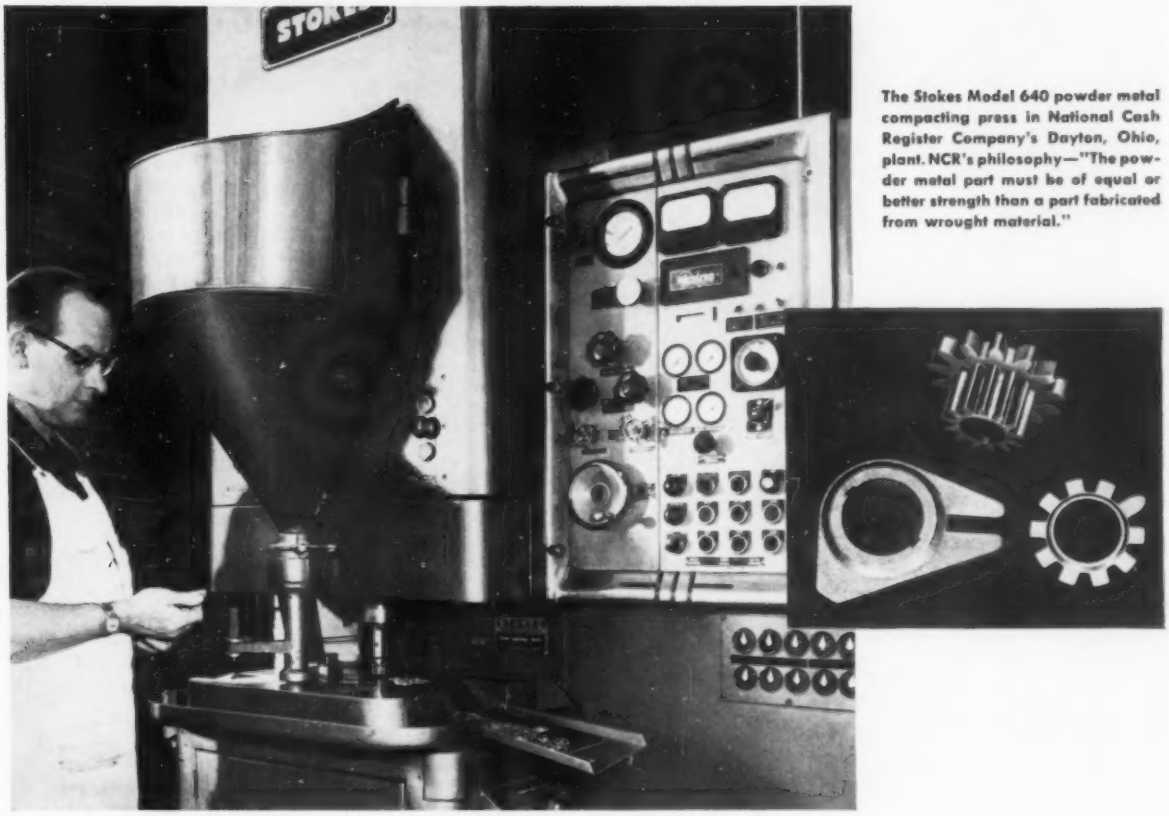
See "Yellow Pages" for nearest office.

DOLLIN Zinc & Aluminum DIE-CASTINGS

For more information circle No. 26 on the Reader Service Card



The Stokes Model 640 powder metal compacting press in National Cash Register Company's Dayton, Ohio, plant. NCR's philosophy—"The powder metal part must be of equal or better strength than a part fabricated from wrought material."

National Cash Register rings up savings through powder metallurgy...

The Stokes Model 640 50-ton powder metal press, at the Dayton, Ohio, plant of National Cash Register Company, has proved a valuable tool in the production of precision gears and parts for cash registers and accounting machines. In 1957, over 250 different high-density parts were made by powder metallurgy—in early '58, 47 additional parts went into production.

The economic benefits of this process have also been proved. A cost analysis of 54 parts shows substantial savings per year through lower direct labor costs in machining and inspection. More complex parts are continually being introduced—parts with hubs, steps, and thin projections—made possible by press equipment such as the Stokes 640.

The Stokes Model 640 offers up to five press motions with independently adjustable compression, fill and ejection points . . . each with direct reading position indicators calibrated to .001". This set-up versatility is teamed with operating simplicity that enables economical long or short runs, and permits easy re-runs of jobs on which set-up standards have been established.

Investigate the proved potential of powder metal pressing . . . not only for ways to cut costs and save metal over conventional machining, but also for ways to get properties of metals, alloys and mixtures not attainable by other techniques. Ask for a production and economic analysis on your own parts. Stokes' facilities include sample production, punch and die design and fabrication, and operator instruction. Stokes Engineering Advisory Service is ready to serve your powder metallurgy needs, whether large or small.

Powder Metal Press Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

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Investment casting eliminates costly machining of this Hipernik® magnetic alloy component.

complete facilities for investment casting... speed development... cut costs

At the Westinghouse Metals Plant in Blairsville, Pa., complete facilities for investment casting now produce startling results in cutting your costs of development. Skilled personnel will design, engineer and produce parts to your specifications. You avoid heavy capital investment.

Intricate and complicated shapes in a variety of alloys are produced as a single piece through cost-saving investment casting. After complete physical testing, your part ships ready for production assembly. Final machining can be done at Blairsville.

Whether your needs are for prototype or production quantities, you can get fast, dependable service from Westinghouse. Find out today how investment casting can help you. Write: Westinghouse Electric Corporation, Materials Manufacturing Department, Blairsville, Pa.

J-05008

YOU CAN BE SURE...IF IT'S Westinghouse

For more information circle No. 70 on the Reader Service Card

LETTERS

continued from page 15

BARREL MEDIA

I have been referred to the article in your September, 1958 issue of PRECISION METAL MOLDING on Metal Bonded Media For Barrel Finishing. Could you please forward a copy of the article to the undersigned?

We do considerable contract finishing for the metal molding plants in this area (Chicago-ed.). It would be advantageous to be on your mailing list if you feature articles on mechanical finishing processes. —R. J. C., pres.

The Metal Bonded Media is presently made by Dixon Sintaloy Co. in a variety of shapes and grits. The article and full information have been forwarded. R. J. C. will certainly start to get PMM.—ed.

DIE CASTING STEELS

Would it be possible for us to obtain 100 copies of page 42 from the August, 1957 issue of PMM. This is the Technical Reference File dealing with steels for die casting dies.—I. L., gen. mgr.

INDUCTION WELDING

One of our customers asked if powder metal parts could be induction welded. Do you have any information on this subject?—R. L. H. sls. mgr.

We are not familiar with a welding process called induction welding. Possibly the reference is to induction heating prior to impact welding. If any of our readers know about such a process we will be glad to convey the information to our reader.—ed.

MACHINING DIES

We are interested in obtaining information regarding practices used in the machining or build-up of die casting dies and/or plastic mold dies. If there are any books or publications available on this specific subject, will you please advise as to title and source.—E. G. G., metallurgist.

Your surest start for fine die casting: Federated-Asarco Di-Metal is made from special high grade zinc, electrolytically refined by Asarco-developed processes. Production is now concentrated "under one roof" at Corpus Christi, Texas, one of the world's largest high grade zinc producing plants. Integrated production—controlled from mine to finished alloy—assures you of lower cost materials, and the highest purity and uniformity of zinc Di-Metal. Federated can serve your needs through 22 sales offices. There's one near you. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd.—Toronto and Montreal.

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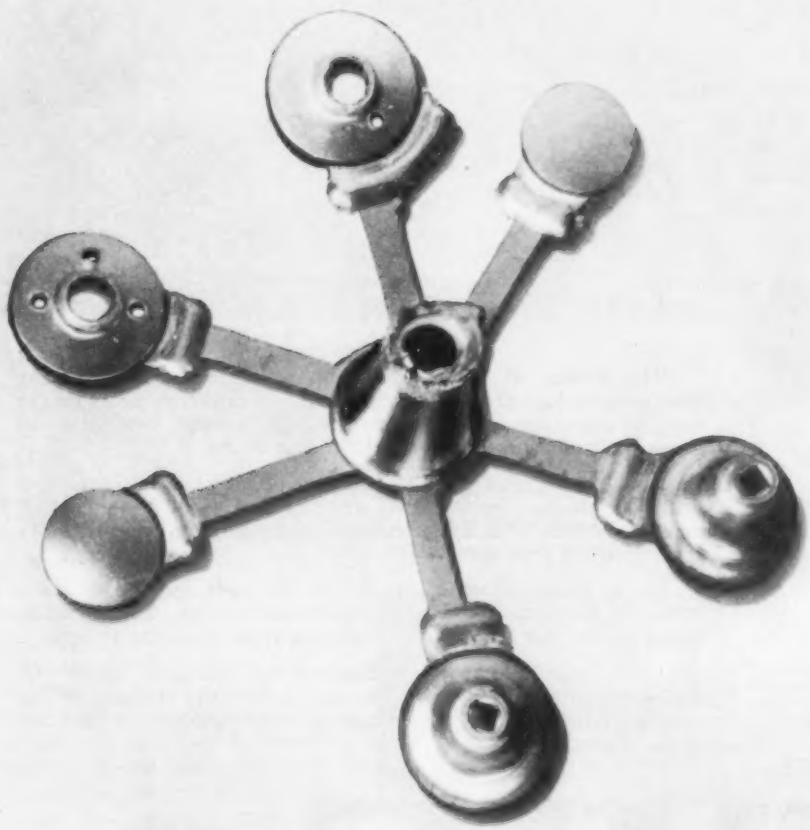

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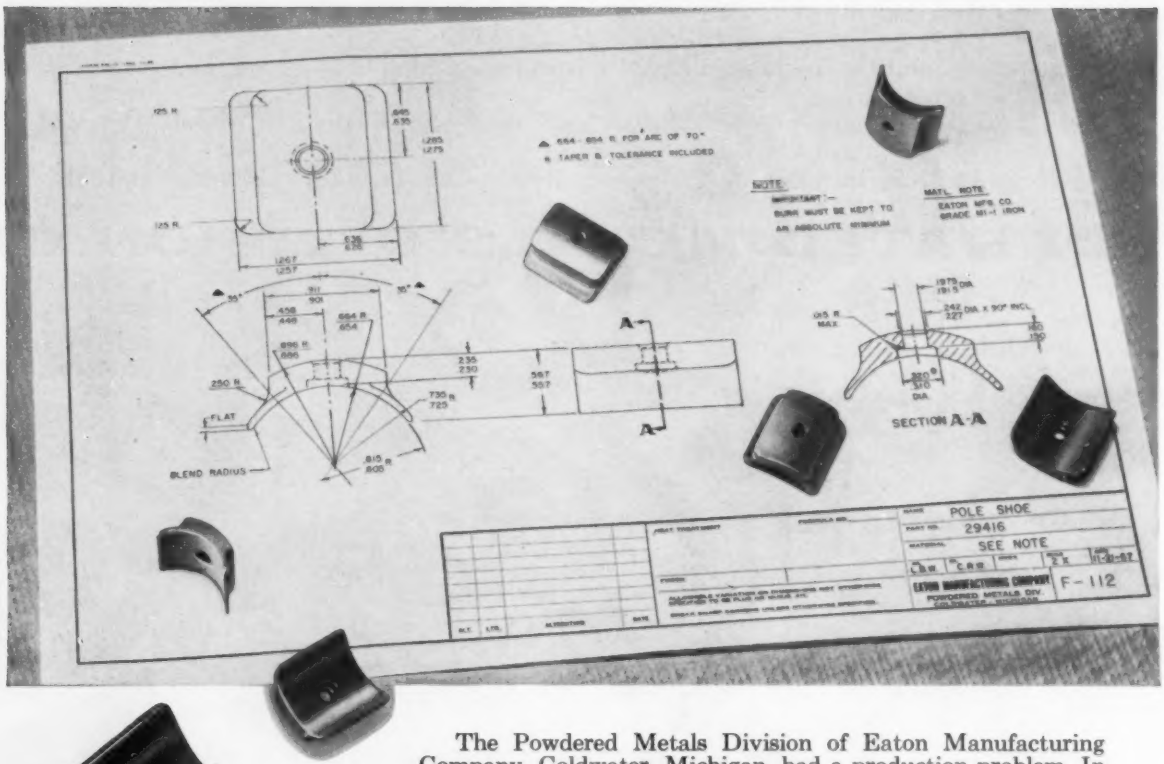
EATON MANUFACTURING COMPANY solved two problems by specifying HOEGANAES Iron Powders - -

- and Hoeganaes Ancor 80 produced good density controls - - good permeability.



New . . . this fact-filled 12-page brochure could be your introduction to powder metallurgy benefits in your metal parts production. Request your copy, now.

The Powdered Metals Division of Eaton Manufacturing Company, Coldwater, Michigan, had a production problem. In fact, two problems . . . both in the high volume production of these fractional horsepower D.C. motor shoes.

But—that's all a part of the past. In a planned corrective program, Hoeganaes Ancor 80 was put to the test and Ancor 80 passed the test with flying colors . . . density and permeability specifications were met.

In addition, Hoeganaes Ancor 80 produced good green strength, long tool life and excellent uniformity. That's really flying colors when it comes to passing rigid production tests.

Your nearby Hoeganaes Engineering Specialist offers you this same kind of test cooperation . . . towards the end of improving *your* metal parts production. A word from you and he's at your service, too.

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SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Los Angeles, Minneapolis, New England (Elmira, N.Y.), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

For more information circle No. 38 on the Reader Service Card

BOOK REVIEW

SEPARATION & PURIFICATION OF MATERIALS, By Rolt Hammond, Philosophical Library, New York, N.Y., 1958. Price: $10.00

Separation & Purification of Materials is one of a series of reference books for those in the chemical engineering industries. This volume covers solid-solid, solid-gas, liquid-liquid, liquid-gas and gas-gas systems. A chapter on separation and purification in nuclear engineering is included.

The author describes the main types of equipment available so that a suitable choice may be made for specific purposes. Special attention is given to atmospheric pollution both by sulphur compounds and by dust.

DISPERSION OF MATERIALS, By Rolt Hammond, Philosophical Library, New York, N.Y., 1958. Price: $10.00

Another in the series of books on the 'Physical Processes in the Chemical Industry', is *Dispersion of Materials*. This volume deals with the principles and practice of crushing, grinding and classifying materials, including special methods needed for the processing of very hard ones and other difficult materials.

Other chapters cover fluidization, flotation, liquid dispersions and dispersion of gases and atmospheric pollution.

INTRODUCTORY GRAPHICS; By J. Norman Arnold, McGraw-Hill Book Co., Inc., New York, N.Y., 1958. Price: $7.75

Introductory Graphics emphasizes graphical solutions to engineering and mathematical problems. Designed to help the beginning student of engineering, the book presents the graphic representation of objects, data and physical phenomena, as well as solution of space and graphical analogue problems. The book is divided into three parts: Part I — Graphical Equipment and Its Use; Part II — Graphical Representation; Part III — Solution of problems. Chapters on graphical calculus and empirical equations are also included.

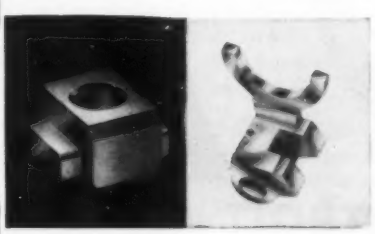
The book contains over 900 illustrations.

A NEW FREEDOM IN BEARING APPLICATIONS

Availability of Sintered Powdered Metal Bearings and machine parts from a fully competent and technically responsible source opens the way to improvements in mechanical products.

Bunting facilities for designing, engineering and manufacturing of Sintered Powdered Metal Bearings and parts are as comprehensive and responsible as the traditional Bunting competence in the field of Cast Bronze Bearings.

A competent group of Bunting Sales Engineers in the field and a soundly established Product Engineering Department put at your command comprehensive data and facts based on wide experience in the designing and use of Cast Bronze and Sintered Powdered Metal Bearings and parts.



Write for catalogs and your copy of the new 24 page Bunting Engineering handbook of Sintered Powdered products and their composition, manufacture and application.

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BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

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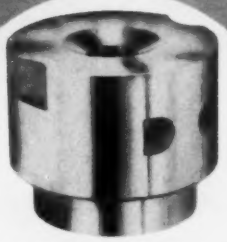


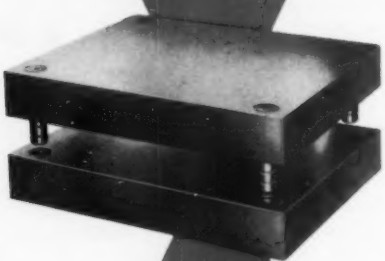
D-M-E STANDARD
Water-Cooled
SPRUE BUSHINGS

DIE CASTERS!

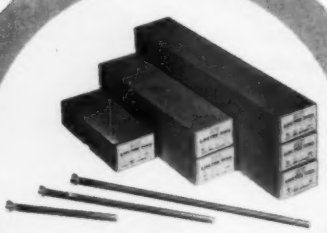
SAVE MONEY ON YOUR DIE CASTING DIES

D-M-E Standards can save you time and money on every die with less initial cost and longer die life.

D-M-E STANDARD
Water-Cooled
SPRUE SPREADERS



D-M-E STANDARD CAVITY RETAINER SETS
Available in Carbon or Alloy Steel



D-M-E STANDARD
Hotform and Nitralloy
EJECTOR PINS

Wide Range of Standard Sizes

from 9⅞" x 8" to 23⅞" x 35½".

Standard plate thickness from ⅞" to 5⅛".

Ground flat and square — ready for cavity inserts.

SEVEN BRANCHES TO SERVE YOU. Write TODAY for Complete Prices and Specifications

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D-M-E CORP.	502 BROOKPARK RD. CLEVELAND, O.	550 LEO STREET DAYTON, O.
D-M-E OF CANADA	156 NORSEMAN AVE.	TORONTO, ONT.

$58-B

For more information circle No. 25 on the Reader Service Card

Broader applications with fabricating ease now possible with Republic Type 6460 Powder

Type 6460 **H**igh **S**trength Powder is another result of Republic's Project 501. Type 6460 is a soft, alloy powder that provides excellent carbon compatibility for **H**igher **S**tressed structural parts—plus the advantage of excellent heat treat response.

I PHYSICAL PROPERTIES

A. Tensile Strength—In the presence of a 1% graphitic condition, physical properties can be obtained ranging from 55,000 psi at 6.2 sintered density to 72,000 psi at 6.6 sintered density.

B. Compressibility—

Briquetting Pressures	Green Density
22 tons at 6.0	6.2
26 tons at 6.4	6.4
32 tons at 6.6	6.6
40 tons at 6.8	6.8

C. Dimensional Change—With 1% graphite, from —.0032 inches per inch at a 6.2 green density to —.0018 inches per inch at 6.6 green density.

D. These values obtained by sintering in an Endothermic Atmosphere: air-gas ratio 2.5 to 1; dew point + 10° to 13°F; 2050°F; 30 minutes at heat.

II APPLICATIONS

A. Can be used for comparable strength structural parts at lower manufacturing costs than obtainable with copper infiltration. In addition, Type 6460's excellent carbon compatibility lends itself to normal accepted heat treat procedures.

B. Ideally suited for use in all major applications of ferrous powder metallurgy. Now, **H**igher **S**trength, **H**igher **S**tressed parts can become a reality using existing equipment.

C. Can be used to fabricate larger parts on normal pressing equipment. Republic Type 6460 Alloy Powder's compressibility provides this extra fabricator benefit.

Write Dept. PM-6528, 1441 Republic Building, Cleveland 1, Ohio, for technical data sheet on chemical composition, physical properties, and test evaluations. Republic Powder Metallurgists and Engineers will help you utilize all the advantages of Type 6460 Powder. This service is confidential and without obligation.

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MEMO

Oct. 1, 1958

To — PMM READERS

From — David W. Veit—publishing director

Subject — Editorial on Extrusion

You asked for it. You asked us to cover extrusions along with the other PRECISION METAL MOLDING processes. Early this year we surveyed 2,000 of our readers and found that 78% of them want regular information about extrusions. More than 56% said they now use extrusions in their products and another 23% are considering them.

With this interest as an incentive, we checked to see how extrusions fit the PMM pattern. How are they designed, specified, bought and produced? What types of products do or can use extruded parts? How are they finished and assembled?

Extrusions are formed in steel dies in relatively large volume, with good surface finish, low cost and accurate dimensions. They fit the type of engineering and purchasing common to the other PMM processes. They offer, in fact, one more way for the product designer to use precision steel dies to cut down on the amount of labor that goes into his finished product.

What types of products can use extrusions? You gave a good idea of this. Those of our readers who said they now use extrusions manufacture more than 60 different types of products. Here are a few: food handling equipment, lighting fixtures, furniture, tape dispensers, bottle cappers, business machines, mechanical pencils, ladders, engineering instruments, electric appliances, vacuum cleaners, builders hardware, pole line hardware, elevators, compressors, hydraulic controls and many more.

Checking Department of Commerce figures, we noted that between 1952 and 1957, shipments of aluminum die castings and permanent mold castings had climbed from 316.1 to 605.9 million pounds. Similarly, from 1953 to 1957, aluminum extrusion shipments had jumped from 393.1 to 706.6 million pounds. Designers are plainly calling for more and more of these precision moldings, whether injected into a steel die in the molten state or squeezed through a die in plastic condition. The fact is, these processes are solving many current production problems.

As a result of these studies, PMM now adds one more process to those it will cover regularly. Starting in this issue, extrusions will be featured editorially. You'll see articles on design pointers, buying practices, tolerances, finishing, process data, properties, case histories, and other helpful information on extrusions.

Although a large field of use exists for aluminum extrusions, PMM will not limit itself to this metal. All extrudable metals will be reported: brass, steel, titanium, stainless, magnesium, cobalt alloys and others. Likewise, all variations of the extrusion technique: hot, cold and impact, will be given editorial attention.

In the interests of editorial balance, PMM will devote articles to the basic facts on extrusions for the benefit of those who are looking into the process for the first time, as well as more complex subjects related to engineering and metallurgy. New developments in the field will be treated, along with the fundamental concepts necessary to proper use of extrusions.

If you are looking for a magazine to give you regular, authoritative and helpful information about extrusions and the extrusion process, we think you'll find what you are looking for in PMM. We have scheduled extrusion articles in every issue.

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CLEMSON PRECISION LAWN MOWERS have proved through twenty years of experience the best way to build strong, durable machines requiring complex precision parts at low cost.

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ACHESON

dispersions digest

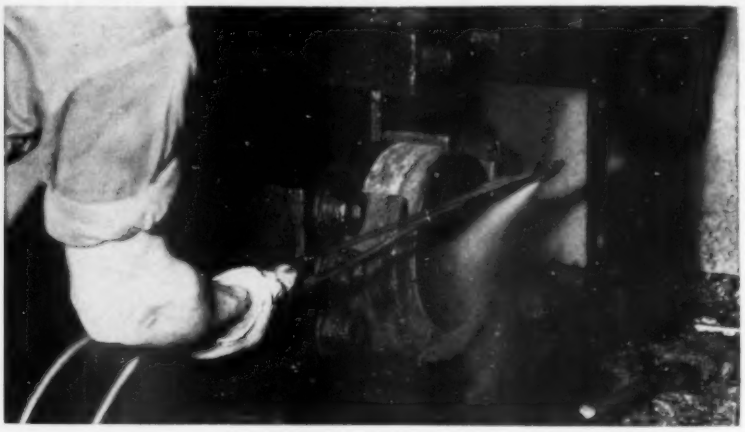
Reporting uses for

dag BRAND DISPERSIONS

COLLOIDAL GRAPHITE, MOLY-SULFIDE, VERMICULITE, AND OTHER SOLIDS

WHY 'DAG' DISPERSIONS MEAN *PERFORMANCE* IN ALUMINUM EXTRUDING

The excellent lubricating properties of Acheson Colloidal Graphite, under conditions of extreme heat and pressure have been confirmed by leading extruders of aluminum, steel, copper, brass, lead and other metals. Water-base dispersions of colloidal graphite used in the following application histories have provided savings in material handling, reduced maintenance time and expense, prevented seizure, extended die life, and produced extrusions of more uniformly high quality. Any one of these benefits should make profitable reading for you.



For faster, more uniform application with less material consumption, Aluminum Extrusions, Inc. finds 'Aquadag' their best die lubricant.

A little 'Aquadag' goes a long way for Aluminum Extrusions, Inc., Charlotte, Michigan. This company, one of the leading independent extruders in the country, has found that by applying 'Aquadag' on die surfaces they have effected a 30% savings in their material handling. Formerly, they had used an oil-graphite mixture which required a dilution ratio of 16 lbs. of graphite to a 55 gallon drum of oil. It was too slowly applied by swab and too coarse to apply by spray with any degree of efficiency.

With 'Aquadag', Aluminum Extrusions has a lubricant that is finer in particle size, permits wider coverage, and provides greater "sprayability". These minute particles pass freely through the spray nozzle, eliminating the costly downtime formerly involved in cleaning clogged equipment. The tough, dry film 'Aquadag' forms upon the evaporation of its water carrier, doesn't smoke or react when applied to hot dies and metals. This improves working conditions as well as extends die life. Important also to both die surfaces as well as the finished extrusion, is the fact that this durable, low-friction film allows easier, more uniform metal flow.

Considered in relation to the over 12 million pounds of aluminum extruded yearly at this plant . . . 85% of it in fabricated form . . . *'Aquadag' has brought important production efficiencies and material economy* to Aluminum Extrusions, Inc. In many, similar instances where product quality and basic economy are demanded, Acheson colloidal dispersions have gained ready acceptance.

Exclusive Acheson processing techniques guarantee a consistently uniform top-quality product. If your problem is more effective lubrication under normally adverse conditions of extreme temperature, pressures, or abrasion, call in your Acheson Service Engineer.

Extended die life and extrusions with more perfect surface finish, are attributed to the use of 'Aquadag'.

Dies last three times longer with 'Aquadag', according to another prominent midwest extruder. Metal pickup on the extruding dies has been completely eliminated by the use of this Acheson dispersion, extending the effective use of the dies from 1000 to 3000 strokes. The evaporation of its water-base leaves a dry, adherent "graphoid" film on all lubricated surfaces, inhibiting the build-up of abrasive precipitates. At the same time, the unbroken, microscopically-thin film that 'Aquadag' provides, facilitates metal flow and reduces scoring to a negligible minimum. Application of the lubricant is by spraying a dilution of 1 part 'Aquadag' to 20 parts water, on the die surface before each "push" of the extrusion press.

A 'dag' graphite coating is also applied to the follow blocks on this company's 1400 ton horizontal extrusion presses. For purposes of even greater economy, 'Prodag' — semi-colloidal graphite in water — is used in this application. This effective parting agent prevents the flash, back-extruded from the billet skin, from locking the butt to the follow block. An Acheson dispersion is very possibly the answer to your lubricating troubles. For additional information, write for your free copy of Bulletin 426. Address Dept. PMM-108.

ACHESON *Colloids Company*

PORT HURON, MICHIGAN

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Also Acheson Industries (Europe) Ltd. and affiliates, London, England

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"THERE'S A REASON FOR OUR ENTHUSIASM . . ."

"Our H-P-M's Give Us Better Quality Castings and Less Scrap . . . Consistently"

Kiowa Corporation, Marshalltown, Iowa, says, "The advanced principles of the H-P-M die casting machines have solved many of our quality problems and our day-to-day die maintenance problems have been reduced. We have two 200 ton, two 600 ton and another 600 ton H-P-M on order."

The new H-P-M die casting machines offer unlimited possibilities for die casting improvements. Here are the reasons: H-P-M's link wedge mold clamp locking mechanism pre-stresses the machine frame so that when metal is injected at high speeds and pressures, the mold is firmly clamped. Frame deflection is minimized due to the "beef" in platen and tie rods. Casting dimensional tolerances and density factors are held; flash is reduced to the minimum; scrap loss is practically nil.

Another important advancement, H-P-M's injection speed control, is infinitely adjustable for acceleration, high speed and pressure follow-through. Intricate detail is accurately reproduced; surface finish is greatly improved; pressure follow-through packs metal for high density.

Remember—for top quality die castings . . . better density control . . . uniform finishes . . . less scrap . . . more year-'round success and satisfaction—H-P-M die casting machines are 'way ahead of the field. Write for Bulletin 5400-J and get the complete facts.

NOTE

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U.S.A.

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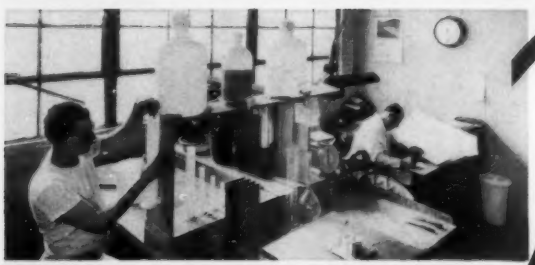

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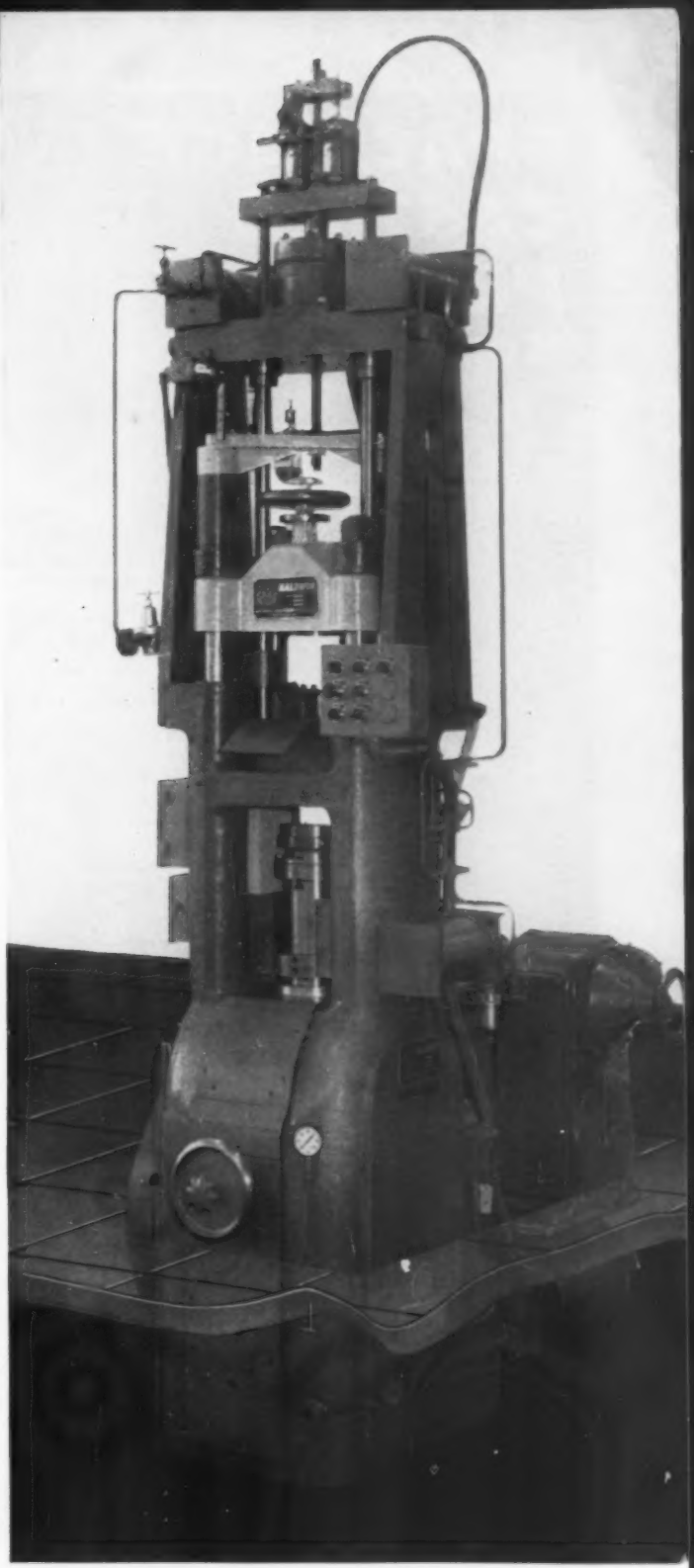
New Baldwin compacting press eliminates raw material loss



Hamilton now offers the powdered metal industry a compacting press which is completely new in design and virtually eliminates the expense and contamination problem of powder loss of basic raw materials.

This 75-ton compacting machine will process such materials as powdered metals, ceramics, abrasives, carbides, cermets, ferrites, nuclear and other solid fuels for rockets and missiles with unprecedented speed and quality.

Another important advantage is that tools from Baldwin's famous 20-A compacting press are interchangeable with those of this new 75-A, and—with adapters—tools from other presses can also be used.

Write today to Dept 14-K for complete information and application data

Hamilton Division Hamilton, Ohio

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SPACE-AGE CASTING PROBLEMS SOLVED WITH

℞MET UNIVERSAL ALLOYS

Highest properties ever demanded! Fail-safe performance! These are the requirements for castings in moon rockets and space stations. Casters use ℞MET UNIVERSAL ALLOYS for precise metallurgical control and consistent quality. Each UNIVERSAL alloy meets many separate specifications.

℞MET UNIVERSAL STAINLESS STEELS

℞MET UNIVERSAL STAINLESS ALLOYS are designed for remelting. Chemical compositions are adjusted for best remelt results. Careful metallurgical control, certified analysis and melt-to-melt uniformity assure consistent high quality castings.

ALLOYS	FOR ALL THESE SPECIFICATIONS					
	AISI	SAE	AMS	ASTM	MILITARY	ICI
℞ 310-U	310	30310	5366A	A296-49T	MIL-S-862A	03925T
℞ 316-U	316	30316	5360	A296-49T	MIL-S-862A-9	03935T
℞ 410-U	410	51410	5350B	A296-49T	MIL-S-16993A	05913T
℞ 416-U	416	51416F	5619E	A276-49T	MIL-S-862A-6	05910T

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STOCK SEVEN ALLOYS FOR ALL TOOL STEEL CASTING REQUIREMENTS! Only seven ℞MET UNIVERSAL TOOL STEELS are needed to meet all specifications for standard tool steel grades. WaiMet also produces special-order tool steel alloys to your exact specification.

℞MET VACUUM-MELTED ALLOYS

℞MET NOW supplies casting alloys specially designed for vacuum melting applications. WaiMet Alloys Co. is the exclusive distributor of ALLVAC alloys to the casting industry.

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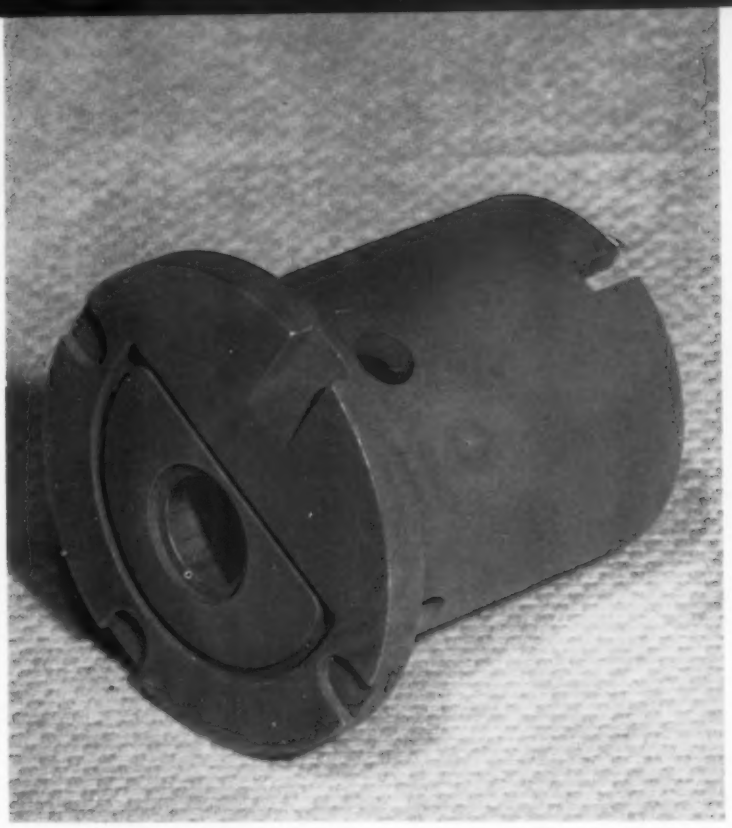
HOW TO USE
INVESTMENT CASTINGS

AUTHORS . . .

HELDENBRAND

INGWERSEN



ALUMINUM INVESTMENT CASTING used as a flanged tube-housing for the fuel-gage tank unit. *Photo: The Minneapolis-Honeywell Regulator Co.*

COVER STORY

How to cut costs 33%

Change to Investment-Cast Aluminum

By JIM HELDENBRAND* and GORDON INGWERSEN**

AN aluminum investment casting is being used to excellent advantage by the Aeronautical Division of the Minneapolis Honeywell Regulator Co. The casting is made for use on the new DC-8 jet transport manufactured by the Douglas Aircraft Corp.

The part is a flanged tube-housing for the tank unit of Honeywell's fuel measuring system. Mounting methods used earlier called for a staked assembly for the tube-housing and flange — and both parts were *machined* in wrought aluminum.

When designing the investment casting used in the tank unit, the diameter of the tube-housing was increased. Because of this, it acts as a pilot-guide for the fuel sensor when it is inserted in the tank.

Increasing the tube-housing's wall thickness makes the casting as strong as the part formerly made of wrought aluminum.

One of the most impressive benefits of the investment casting is a cost saving of approximately 33%.

Die and casting work on the part was done by the Rausch Manufacturing Co.

The material used was 356 aluminum casting alloy in the solution, heat treated, and aged.

Tests show this aluminum investment casting is very satisfactory.

A steel investment casting is now being designed for a similar application on the oil quantity system of the jet transport made by the Boeing Airplane Co.

*Development Engineer, **Materials Engineer, The Aeronautical Division of the Minneapolis-Honeywell Regulator Co.

APPLICATION REQUIREMENTS

1. Tin plating to provide a soldered hermetic seal of the receptacle-cover which brings out the lead-wires.
2. Resistance to jet fuel per MIL-J-5624D
3. Resistance to the corrosive effects of humidity and salt spray tests per MIL-E-5272
4. Fuel sloshing loads
5. Vibration tests on the order of 10 G's from 5 to 500 cycles per second (Mil-G-26988A)
6. Impervious to leaks up to 50 pounds per square inch gage pressure.

The Extrusion Process

The process may be either hot or cold. In hot extrusion the metal is above its recrystallization temperature and is, therefore, continuously recrystallized – there is no work hardening. In cold extrusion the metal never reaches incipient recrystallization temperature and may be work hardened.

Three general methods of extrusion are in common use. *Direct extrusion* (figure 1a) in which the metal is forced through a die so that progression of both metal and the press ram are in the same direction. *Indirect extrusion* (figure 1b) in which the metal flow is in the opposite direction to press ram travel and the extruded shape comes out of the press through an annular opening in the ram. *Impact extrusion* (figure 1c) uses a relatively small billet and a closed die, the extruded metal is then forced up around the punch.

The billets used in extrusion are almost always cast. To secure a wrought structure some reduction is required: otherwise the as cast structure with its segregation, coarse grains, etc. will not be broken up. The amount of reduction varies with the metal composition, the billet size and the method of casting the billet. Generally a minimum of 60% reduction is considered necessary and a reduction of more than 90% is wasteful. These limits will, therefore, define the billet diameter.

In both direct and indirect extrusion the metal flow is the greatest in the center of the billet and, due to friction of the container is the least along the walls (figure 2). Since there will always be some scale, oxide film, and other impurities on the outside of the billet the last metal to extrude will carry most of these impurities. Also a pipe, similar to the pipe formed in ingot casting always occurs. This final material is scrap and must be held as low as possible. One method of doing this is to increase the length of the billet. There is an economical limit to the length and, generally, it is held to a maximum of five times the diameter. Therefore, the two considerations, percent reduction and allowable scrap losses will define the size billet used.

Solid extrusions of almost any desired shape can be made and almost any metal or alloy can be extruded. Except in special cases the cross section shape of the extrusion is uniform along the entire length of the piece. Thus, sections of the required length can be cut from a bar and all of them will be of uniform size, within the accuracy of the process. When required, and at considerably increased cost, stepped extrusions can be made with special die arrangements. It is seldom, however, that the increased cost is justified.

Hollow extrusions can, of course, also be made. The simplest form is tubing. Figure 3 is a schematic view of a typical tube extrusion. The billet may be cast with a center hole, it may be drilled prior to

Extrusion is a method of forming metal parts of continuous cross section by plastically forcing the metal through a die (1)

(1) From Metallurgical Dictionary by J. G. Henderson and J. M. Bates

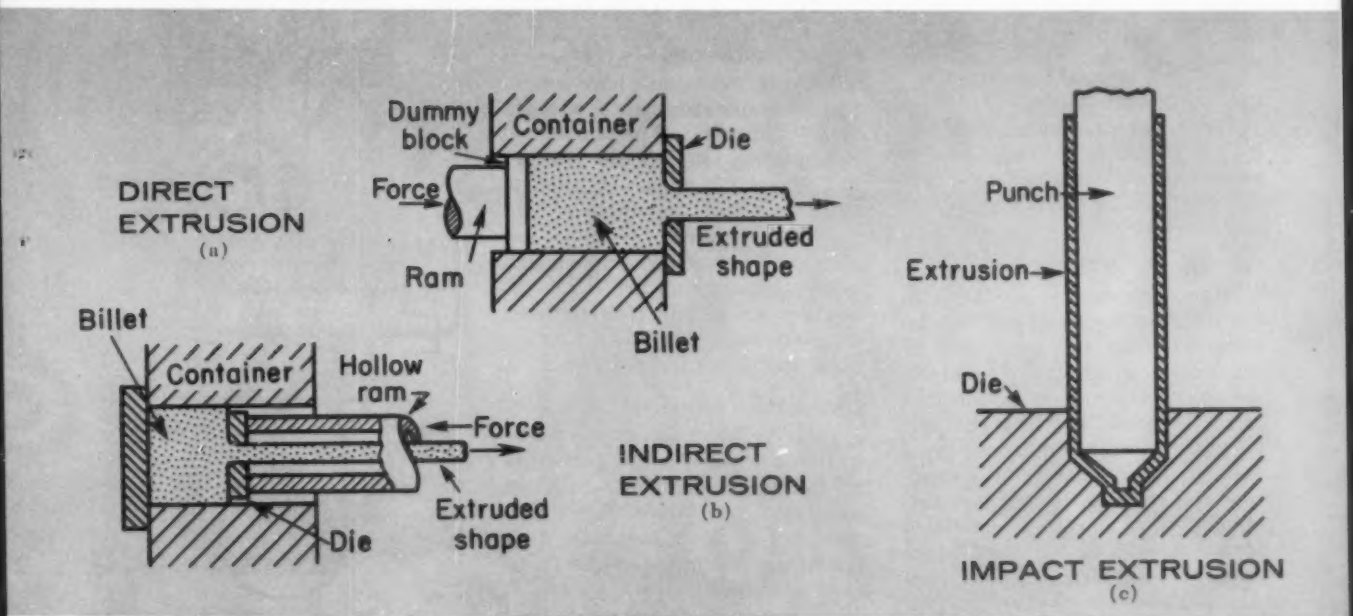


Figure 1

heating for extrusion or it may be pierced by the extrusion mandrel. In any case, the press is fitted with a mandrel which passes through the billet and enters the die. The metal is then extruded in the usual manner except that it is formed around the mandrel. Another type of tube extrusion that is sometimes used requires a so-called "Porthole die" as shown in figure 4. In this method as the metal passes through the zone AB of the die, it is first formed into three or four separate sectors. In the zone BC these sectors are squeezed together. At the high extrusion temperatures and pressures used the sectors weld together, forming the complete tube. This type of extrusion is used mostly for soft materials which can be easily pressure-welded. A similar process is used for cable sheathing.

Impact Extrusion is done cold. A fairly thick disk or slug of metal (generally aluminum, lead, tin, zinc and their alloys) is placed in the cavity of a die (see figure 1c) in the press. The diameter of the slug is approximately equal to the outside diameter of the formed part. This slug is then struck a single blow by the punch which has the shape and size of the inside of the part. The punch strikes the slug with sufficient force to cause the metal to flow, or squirt, upward through the space between the punch and the die cavity. The formed part adheres to the punch when it is withdrawn from the die and is removed from the punch by a stationary stripper.

DESIGN CONSIDERATIONS

The extrusion process yields many design possibilities not economically attainable by other production methods. These factors include reentrant angles and undercuts, thin wall tubing of large diameter, variations in section thickness, the ability to put metal where it is needed, almost without restrictions. Probably the most important factor in the extrudability of a shape is symmetry, preferably around both axes. There are some general design considerations that should be followed when ever possible. These preferred general designs are shown in figure 5.

TOLERANCES

Dimensional tolerances are difficult to generalize about. While extruded shapes certainly minimize and often eliminate the need for machining, they do not possess the dimensional accuracy of machined parts. The wider tolerances required on extruded parts must be taken into account when designing for their use.

SURFACE FINISH

In many cases, the smooth finish of extruded shapes is satisfactory for the intended use without further surface treatment of any kind. Where cut-off is done a slight burr may result that must be re-

moved. This same is true when holes are drilled and tapped.

Small parts cut from extruded stock are frequently barrel finished in the same manner that castings are handled. Painting, plating, vacuum coating and surface conversion coatings are all utilized on extruded shapes and no special precautions need be taken other than to know the alloy from which the extrusion is made and finish accordingly.

CORROSION RESISTANCE

The corrosion resistance of extruded shapes is the same as that of the metal composition. The fabricating method does not change this property at all.

MACHINING

If an alloy can be machined in the wrought form and can also be extruded, then the machining of the extrusion will, in general be the same. The only exception that might be found is where the percentage of reduction is not great enough and some of the cast structure still remains. In this case machining might have to be modified to correspond to the working of castings in the particular alloy. Naturally these same considerations apply when considering finishing, corrosion resistance, etc.

JOINING

One of the great advantages of extruded shapes is found when two or more parts must be assembled into a single component. A wide variety of fits and mating surfaces can be formed in the extrusion process that permit fast, economical assembly. When joining by such methods as welding, soldering, brazing or adhesives is done the joint can be designed for highest strength and the most economical joining.

PHYSICAL PROPERTIES

Because extrusions have essentially the same structure as wrought metals their physical properties will be about the same. If, for any reason, recrystallization is not complete there may be some minor deviations, but these will seldom be important. The somewhat elongated grain structure can give small differences in properties between transverse and longitudinal directions; this is seldom significant.

MECHANICAL PROPERTIES

Extruded stock has approximately the same mechanical properties as hot rolled wrought stock. In most cases any appreciable difference will favor the extrusions, particularly when tested in the transverse direction.

When compared with cold rolled wrought stock, however, extrusions will show somewhat lower physicals. Fully annealed cold rolled stock will have about the same properties as extrusions.

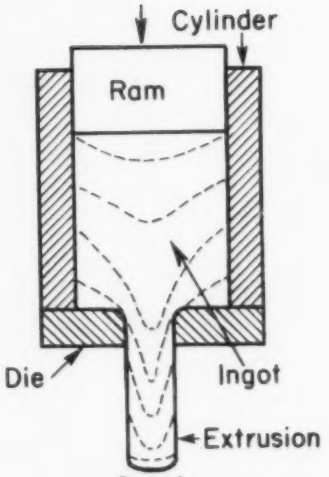


Figure 2

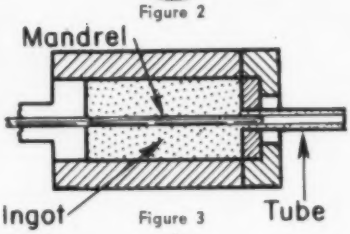


Figure 3

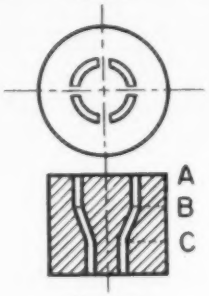


Figure 4

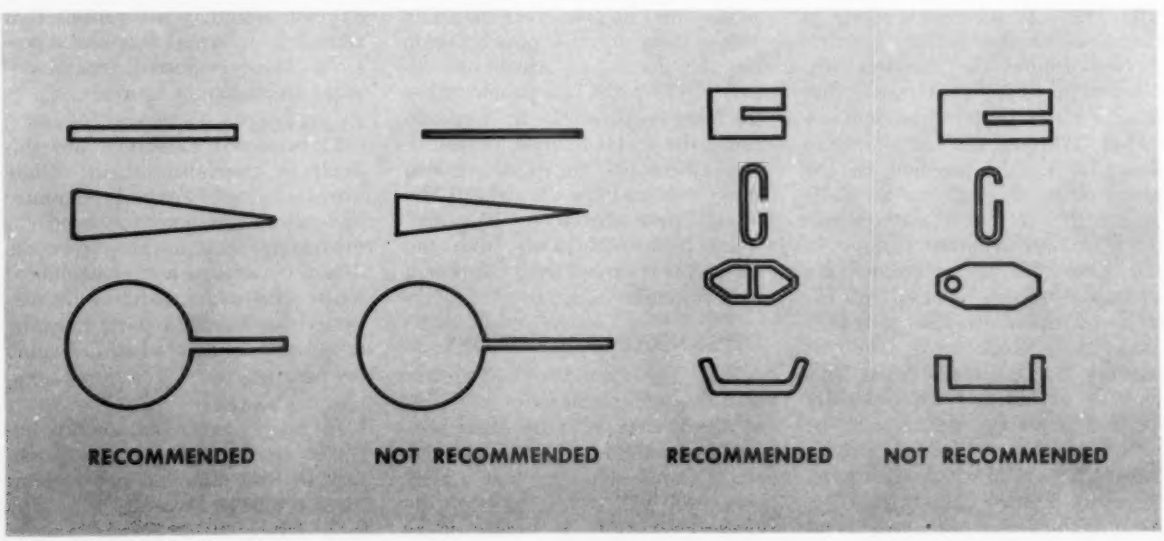
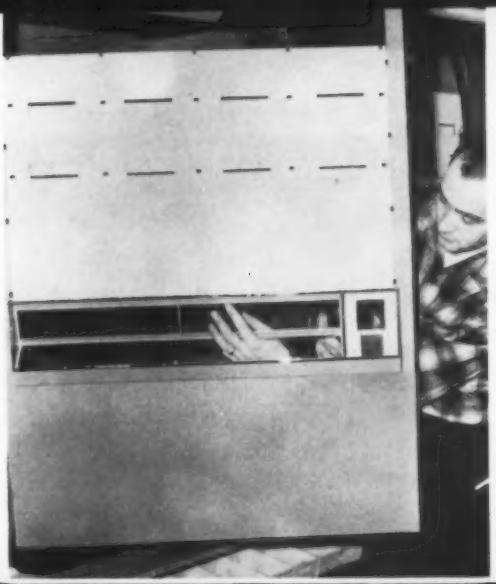


Figure 5

CHECKED for dimensional specifications, each bezel must pass inspection.

ACCURATE die casting simplifies insertion of tray bezel into door-housing.

DIE CAST selector button and tray bezels are being checked after assembly.



Photos: Ainsworth-Precision Castings Co.

You Get Better Bezels with Zinc Die Castings

DESIGN engineers know what they want. In this case, *it's die castings!* Zinc die castings with a fine, as-cast surface so that machining costs can be cut and the look of the castings improved.

They got what they wanted – A pair of smooth, fine-finish zinc die castings that met the detailed specifications needed in a huge, modern, cigaret vending machine, made by Rowe Mfg. Co.

The problem solved by the Ainsworth Precision Castings Co., Division of Harsco Corp., was how to cast a pair of bezels used on the machines. A button bezel, and a tray bezel.

Both are 31 inches long and seven inches wide. Their thin edges must be straight and true, without distortion or warpage. Overall dimensions must be held to close tolerances.

The button bezel has a cast-in coin insert which must be made to extremely close tolerances. It also has 20 equally spaced, thin-walled louvres which separate the pack-selector buttons.

The tray-bezel grooves are designed to hold the glass panel, and to hold the positioning bosses. Both parts must have flaw-free surfaces.

These parts are assembled into an electrically-operated, console-type cigaret vending machine. Producing the two bezels by any other method but die casting is too costly. Among other things, machining and surface-finishing are expensive.

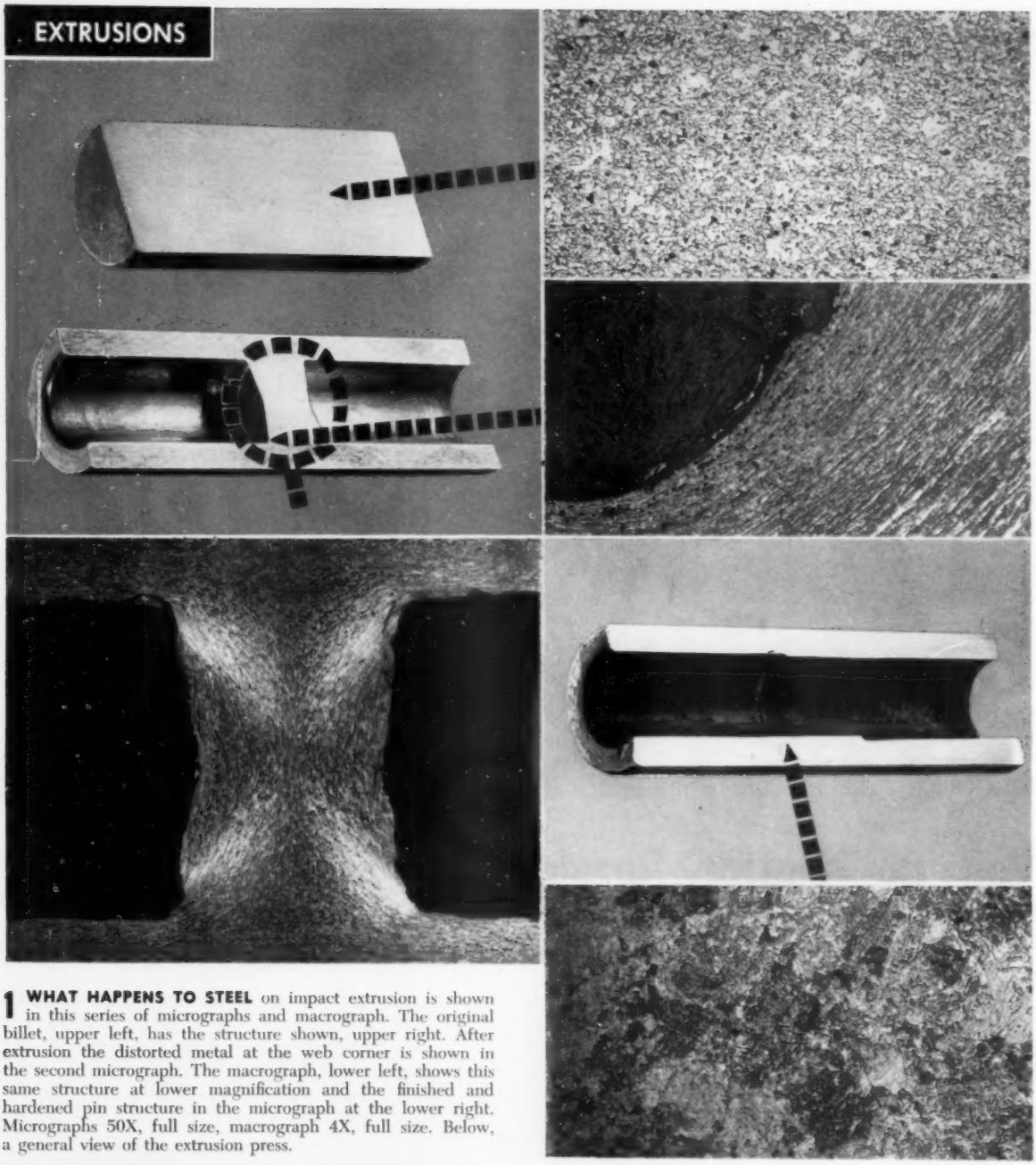
Stamped parts were out! Stamping makes it necessary to spot weld the studs. Also, a stamping's exposed areas must be ground.

But most important: There is no assurance that stamped and welded parts will have identical dimensions.

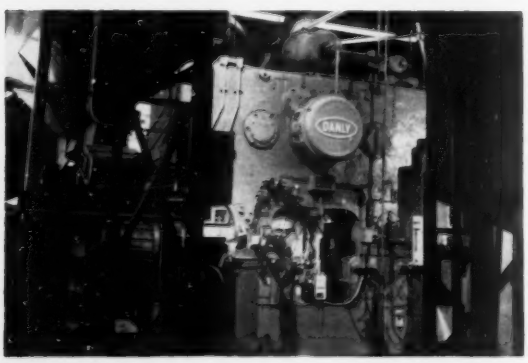
Plastics were not considered at all.

Rowe engineers wanted complete, die-cast units that were ready for installation in the cigaret vending machines – and that's what they got!

Two types of finishes are used. One is sand blasting, followed by plating copper-nickel-chrome on the bezel's trim. The second way is to mask off certain areas and spray-paint the background by hand with an aluminum pigmented epoxy resin. This looks like a satin-chrome finish and has a lot of wear and impact resistance.



1 WHAT HAPPENS TO STEEL on impact extrusion is shown in this series of micrographs and macrograph. The original billet, upper left, has the structure shown, upper right. After extrusion the distorted metal at the web corner is shown in the second micrograph. The macrograph, lower left, shows this same structure at lower magnification and the finished and hardened pin structure in the micrograph at the lower right. Micrographs 50X, full size, macrograph 4X, full size. Below, a general view of the extrusion press.



Impact Extrusion Of Steel Wrist Pins

THE extrusion of steel is a relatively new development, especially when compared to the extrusion of the non-ferrous metals. That's why the impact extrusion of wrist pins for automobile engines by the Ford Motor Co. is such an unusual fabricating method.

The wrist pin in a modern, high-compression engine takes a severe beating. It is subject to wear and to high stresses in shear, impact and compression. These operating conditions call for a steel that is extremely hard and tough. But to extrude steel calls for a soft, highly ductile material. The two just don't seem to be compatible.

To further complicate the picture, the pin should be extruded to almost finished size or there will be no manufacturing cost saving.

Ford engineers and metallurgists have found the solution to these problems and are making highly satisfactory wrist pins at the rate of 2000 per hour at about one-half the cost of pins made by older, more orthodox methods.

Here's how they do it.

WHAT STEEL IS USED?

To be extrudable, the steel must be soft and ductile. But to stand up in service the steel must be tough, strong and wear resistant. A low carbon, low alloy steel that can be case carburized is indicated.

The particular steel chosen is AISI 5015, cold drawn and annealed. The metal has a fine grain structure as shown in figure 1 and is quite ductile. This steel has a composition of:

Carbon	0.12 - 0.17
Manganese	0.30 - 0.50
Chromium	0.30 - 0.50
Phosphorous	0.04 max.
Sulfur	0.04 max.
Silicon	0.20 - 0.35

As received its hardness is 140 Brinell, equivalent to a tensile strength of about 70,000 psi. It's heat-treatable and can be case carburized.

EXTRUSION OF THE PINS

CUTTING THE BILLETS

One of the characteristics of impact extrusion is the absence of scrap. In most cases the entire extrusion billet is used in making the part. Also, in impact extrusion there is little, if any, change in diameter from billet to finished part. Both of these characteristics are true of extruded wrist pins.

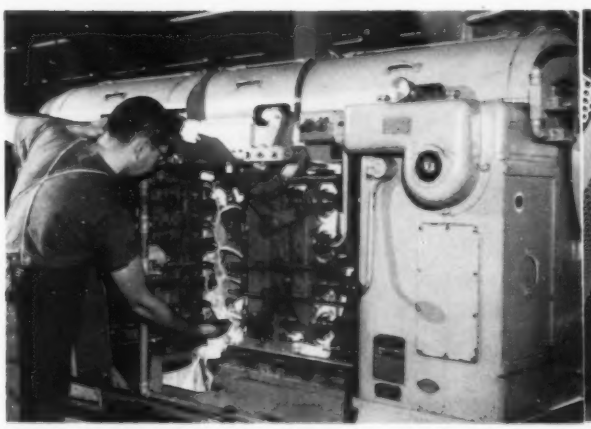
The bar stock of proper diameter is fed to a multiple spindle Conomatic cut-off machine seen in figure 2. This machine is somewhat unusual because it cuts extrusion slugs to a weight tolerance instead of a length tolerance – in this case the weight is held from 228.5 grams to 229.5 grams.

PREPARATION OF THE BILLETS

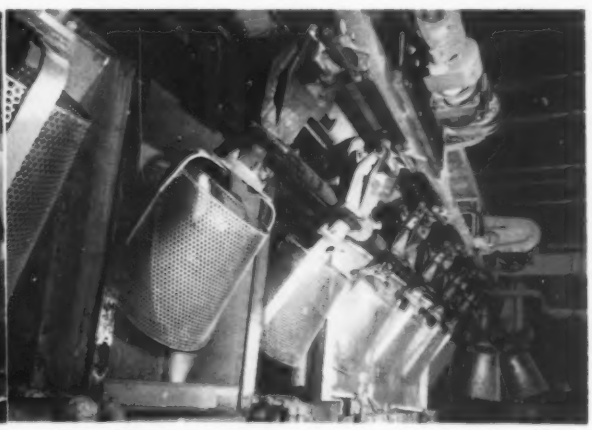
One of the problems in the extrusion of steel is lubrication of the die. Under the high unit pressures involved, friction between the part and the die can be excessively high. Without proper lubrication seizing and galling may occur and the pressures required for extrusion would be tremendous. The best lubricant found so far is a special soap-like material. To secure adequate adhesion of the lubricant on the steel the slugs are first treated to produce a zinc phosphate surface coating. This conversion coating furnishes a firm bond for the lubricant. The entire phosphating and coating operation is done on a fully automatic Stevens barrel finishing machine shown in figure 3. The particular lubricant now in use is Bonderlube. A billet cut to size and fully surface treated is shown in figure 4.

From the phosphating unit the billets are fed, automatically, to the extrusion press.

continued on next page

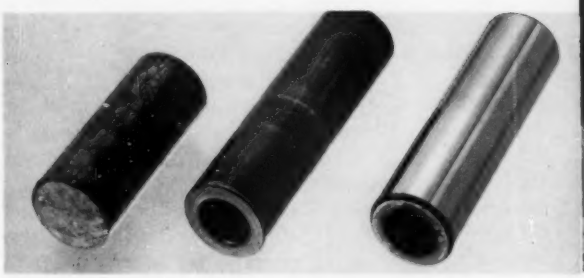


2 BILLETS CUT TO WEIGHT are the unusual feature of this Conomatic cut-off machine. Normally bar stock for processing is cut to length, but to assure proper engine balance all of the wrist pins must weigh the same. The extrusion process is so accurate that, with a one gram weight tolerance, the length can be held to ±0.005. Later, the finished wrist pins will be automatically inspected and sorted according to outside diameter, bore diameter, length, etc.

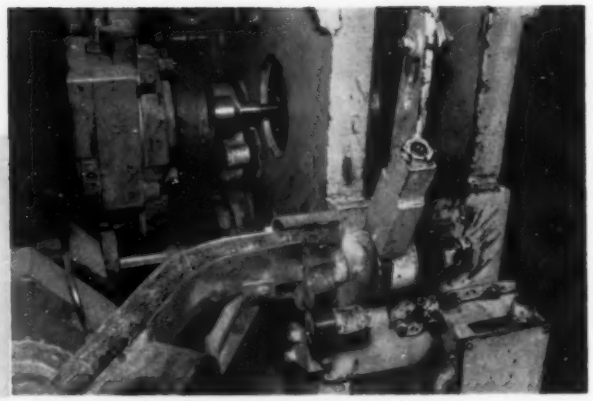


3 LUBRICATION OF THE BILLET is extremely important, otherwise skin friction between the steel pin and the die wall would require excessive pressures to accomplish the extrusion. A fully automatic, Stevens phosphating machine is used to apply a layer of lubricant on the pins. Rotating barrels carry the pins from tank to tank. First the pins are thoroughly cleaned, then a zinc phosphate conversion coating applied and finally the desired lubricant, in this case Bonderlube, is applied.

continued from preceding page



4 THREE STAGES IN MAKING a wrist pin. From left to right the billet of SAE 5015 steel, phosphate coated and lubricated with a soap like material. Center the extruded pin as it leaves the extrusion press. The pin is of correct length and correct inside diameter. It still contains a center web approximately 0.035" thick. Note that at this stage, the pin has been sized for length and a chamfer formed on the bore. Right, the finished pin after web removal, hardening and grinding.



5 THE TOOLING FOR IMPACT extrusion is shown in this close-up view. At the lower left the feed of billets from an overhead hopper can be seen. The punch shown is a carbide extrusion punch that will form one-half of the wrist pin. A duplicate punch comes in from the other side. At the extreme forward position of the stroke the pins fail to meet by the thickness of the web, 0.035". Subsequent positions will probe for clear holes, size the length, and form the ID chamfer.

IMPACT EXTRUDING

The press is a Danly shown in figure 1. It is equipped with two horizontal rams, each capable of exerting 200 tons pressure. The rams are synchronized so that movement of both is precisely the same. Each ram carries tooling for the six station holding fixture. The sequence of operations for a complete extrusion cycle is:

1. A billet is fed from a hopper to the first station where it is pressed into the extrusion die. The die is cemented carbide shrunk into a steel sleeve. Its inside diameter is a light press fit for the billet.

2. The work holder rotates 1/6 of a revolution and the extrusion punches enter the slug simultaneously from both sides. These punches, also cemented carbide, strike the billet and force the metal to flow back around the punch. In this operation a web about 0.350" thick is left in the center of the pin as shown in figure 1.

How the metal flows in this step is best shown by the flow lines in figure 1. Here the undisturbed metal can be seen in the center of the web while the displaced metal has been moved to the pin walls. The extruded structure is shown clearly in figure 1.

3. It is possible that a punch might break off in the bore of the pin. If it is not removed considerable tool damage can occur later. The third station is, therefore, a probe. If there is any foreign matter in the hole the probe will find it and stop the press.

4. Because there is a one gram weight tolerance on the billets, there will be a slight variation in the length of the pins. The fourth station is, therefore, a coining step where the wrist pins are sized to length tolerances. In this step a small chamfer is put on the bore of the pin during coining.

5. In the last manufacturing station the extruded pins are pressed out of the work holder and discharged into a feed hopper for the next operation.

6. The sixth station on the work holder is utilized for locating. This precise locating is required to assure the concentricity tolerances. The accuracy of this entire extrusion operation can be appreciated by the dimensional tolerances held. After coining, the total length variation is under 0.005, outside diameter under 0.003 and concentricity less than 0.020 TIR. All of these tolerances are well within the limits set by quality control.

FINISHING THE PINS

After extrusion there remains three general operations. The web must be removed, the pins hardened and the OD ground.

WEB REMOVAL

From the extrusion press the pins are fed to a machine which drills out the 0.350" thick web and reams the drilled hole. At the same time a chamfer is put on the OD.

HARDENING

To secure the properties in the pin that are required the carbon content of the wear surface must be raised to 0.40. This is secured by case carburizing in a Holcroft furnace with an enriched exogas atmosphere held at a dew point of 20°F to 26°F. This furnace has three zones, a preheat and soak at 1500°F, a carburizing zone at 1700°F and a 1600°F zone prior to quench. The complete furnace cycle is 8 hours and the parts are quenched in an aqueous phosphate solution. As hardened the surface hardness is from 61 to 66 R_c. Following this heat treatment the pins go to a tempering furnace where they are drawn at 375°F for one hour and air cooled. This tempering operation gives a surface hardness of 58 to 63 R_c, and a microstucture as shown in figure 1.

FINISHING

After heat treatment the OD of the pins is ground to final size and then 100% inspected on a Sheffield automatic air-gauging machine.

Built to augment production for a subsidiary of one of the big three automobile manufacturers by providing a faster, better means of trimming large castings. This press has tie bar centers of 40" front to back, 52" left to right, 4" tie bars, with a clear die area of 36" x 48" and a 30" stroke. Approach speed is 2000 IPM; return speed, 1000 IPM; power, 30 HP. . . . a very fast and efficient machine. For complete details of this or our smaller die casting trim presses of this type, write or phone.

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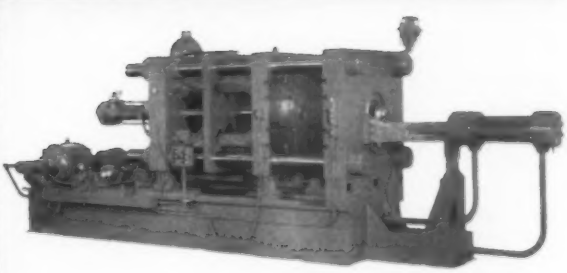

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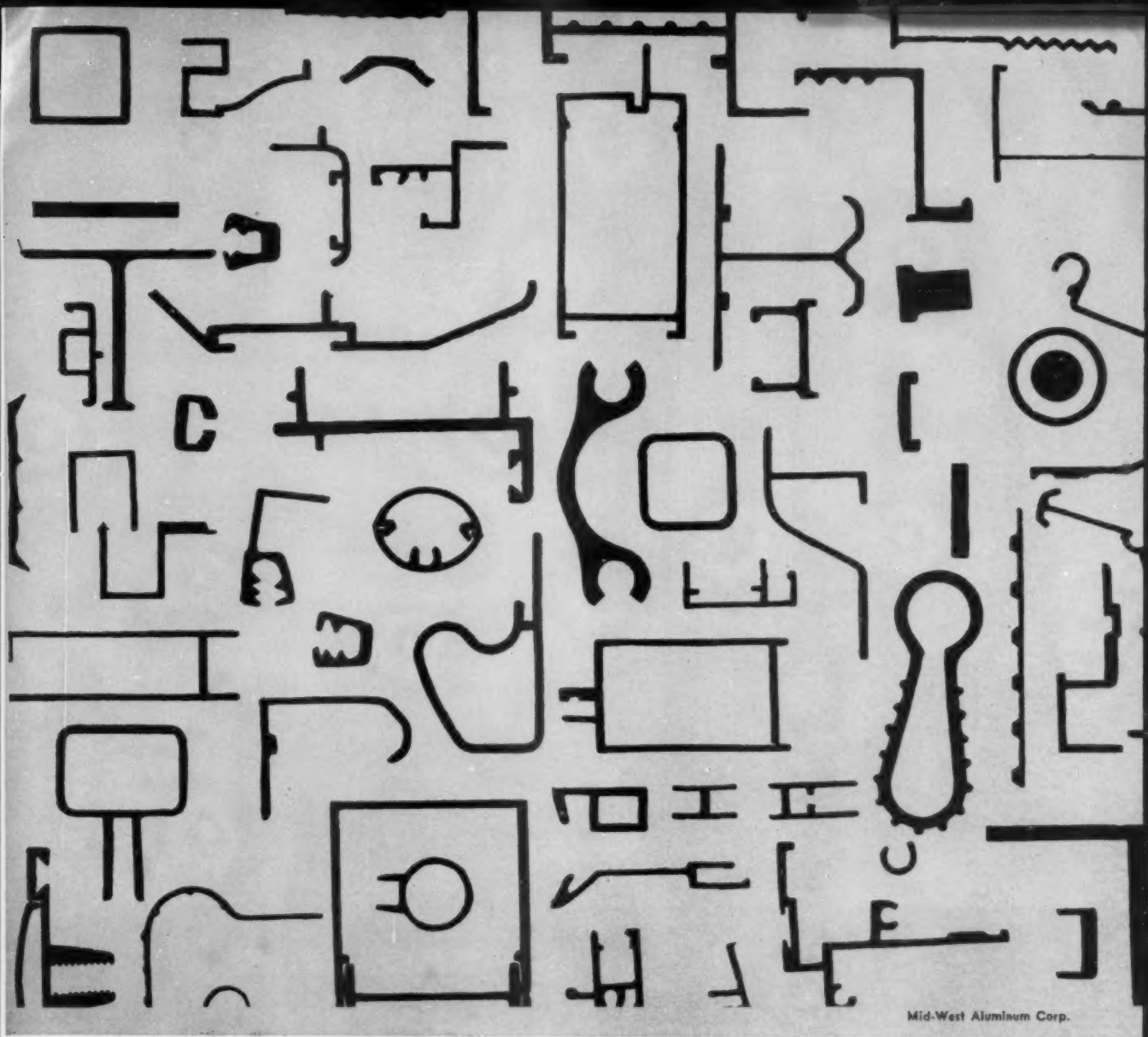


Mid-West Aluminum Corp.

Designing For Extrusions

GETTING the shape you want in the metal that you want is only part of the problem. When the extrusion that the designer wants to use is structural rather than decorative, strength, physical properties, corrosion resistance, chemistry and many other factors must be considered.

Often the properties that can be secured in the finished part will determine whether an extrusion can be successfully used. It is the purpose of the following tables and those to be published in subsequent months, to give the designer all of the information available on the chemistry, physical, and mechanical properties of extrusions in all metals.

No attempt will be made to compile standard extruded shapes, at least not in this series of tables. Extrusion dies are quite inexpensive, often costing only $100 or less. Special shapes to do the job the best are, therefore, generally preferred. This is in contrast to most other metal forming methods where tooling may be very expensive.

Another factor that favors the use of custom extrusions is the speed with which tooling is an extrusion press can be changed. When small dies are used which can be easily handled by one man, the time required for die change is seldom more than five minutes. This means there is no great downtime for the press—hence no large set-up charges.

Most custom extruders are accustomed to short runs and many will make as little as 25 pounds per run. This is true of even very large custom shops.

Therefore, the designer should not hesitate to call for a shape that requires a special die, even though only small amounts are needed per order.

PROPERTIES OF EXTRUDED ALLOYS

TABLE I

Chemical Composition of Aluminum Extrusion Alloys

Alloy[1]		Copper	Iron	Silicon	Manganese	Magnesium	Zinc	Chromium	Titanium	Other	
ASTM	A.A.[5]									Each	Total
—	E.C.[2]	—	—	—	—	—	—	—	—	—	—
990A	1100[3]	0.20	—	—	0.05	—	0.10	—	—	0.05	0.15
CG42A	2024	3.8-4.9	0.50	0.50	0.30-0.9	1.2-1.8	0.25	0.10	—	0.05	0.15
CS41A	2014	3.9-5.0	1.0	0.50-1.2	0.40-1.2	0.20-0.8	0.25	0.10	0.15	0.05	0.15
GS10A	6063	0.10	0.35	0.20-0.6	0.10	0.45-0.9	0.10	0.10	0.10	0.05	0.15
GS11A	6061	0.15-0.40	0.7	0.40-0.8	0.15	0.8-1.2	0.25	0.15-0.35	0.15	0.05	0.15
GS11B	6053	0.10	0.35	[4]	—	1.1-1.4	0.10	0.15-0.35	—	0.05	0.15
GS11C	6062	0.15-0.40	0.7	0.40-0.8	0.15	0.8-1.2	0.25	0.04-0.14	0.15	0.05	0.15
M1A	3003	0.20	0.7	0.6	1.0-1.5	—	0.10	—	—	0.05	0.15
ZG62A	7075	1.2-2.0	0.7	0.50	0.30	2.1-2.9	5.1-6.1	0.18-0.40	0.20	0.05	0.15

Data from Reynolds Metal Co.

(1) Composition in percent — balance not shown in aluminum — single units indicate maximums.

(2) Electrical conductor grade — 99.45% Al minimum.

(3) Commercially pure aluminum, iron plus silicon 1.0% max.

(4) Silicon content to be 45% to 65% of the magnesium content. (Material from ASTM Standards, 1955, part 2)

(5) The Aluminum Association designation.

PROPERTIES OF EXTRUDED ALLOYS

TABLE II

Typical Mechanical Properties of Aluminum Extrusion Alloys

Alloy & Temper		Tensile Strength[1] psi	Yield Strength in Tension psi	Elongation percent in 2"	Shear Strength psi	Endurance limit[2] psi	Brinell Hardness (500 kg load 10 mm ball)
ASTM	A.A.						
CG42A	2024-0	27,000	11,000	22	18,000	13,000	47
	2024-T4	68,000	48,000	19	41,000	18,000	120
CS41A	2014-0	27,000	14,000	18	18,000	13,000	45
	2014-T4	62,000	42,000	22	38,000	18,000	105
	2014-T6	70,000	60,000	13	42,000	18,000	135
GS10A	6063-T42	22,000	13,000	20	14,000	—	42
	6063-T5	30,000	25,000	12	18,000	—	65
	6063-T6	35,000	30,000	12	22,000	—	73
GS11A	6061-0	18,000	8,000	30	12,000	9,000	30
	6061-T4	35,000	21,000	25	24,000	13,500	65
	6061-T6	45,000	41,000	17	30,000	13,500	95
M1A	3003-F	16,000	6,000	40	11,000	7,000	28
ZG62A	7075-0	33,000	15,000	17	22,000	—	60
	7075-T6	82,000	72,000	11	49,000	21,000	150

(1) The modulus of elasticity of all aluminum alloys is about 10,300,000 psi Poisson's Ratio is about 0.33

(2) Endurance limit values are based on 500,000,000 cycles of reversed stress using an R.R. Moore type machine and specimen.

Data from Reynolds Metal Co.

PROPERTIES OF EXTRUDED ALLOYS
TABLE III
Typical Physical Properties of Aluminum Extrusion Alloys

Alloy		Specific Gravity g/cc	Weight per cu. in.	Melting Range of (Approx.)	Electrical Conductivity %[1]	Thermal conductivity @ 25°C C.G.S. Units[2]	Coefficient of Thermal Expansion per deg. F x 10^{-6} [3]	
ASTM	A.A.						68°-212°F	68°-572°F
CG42A	2024-0	2.77	0.100	935-1180	30	0.45	12.9	13.7
	2024-T4	2.77	0.100	935-1180	30	0.29	12.9	13.7
CS41A	2014-0	2.80	0.101	950-1180	50	0.46	12.9	13.6
	2014-T4	2.80	0.101	950-1180	—	—	12.8	13.6
	2014-T6	2.80	0.101	950-1180	50	0.37	12.8	13.6
GS10A	6063-T42	2.70	0.098	1140-1205	50	0.46	13.0	14.0
	6063-T5	2.70	0.098	1140-1205	55	0.50	13.0	14.0
	6063-T6	2.70	0.098	1140-1205	55	0.50	13.0	14.0
GS11A	6061-0	2.70	0.098	1080-1205	45	0.41	13.1	14.1
	6061-T4	2.70	0.098	1080-1205	40	0.37	13.1	14.1
	6061-T6	2.70	0.098	1080-1205	40	0.37	13.1	14.1
M1A	3003-F	2.73	0.099	1190-1210	41	0.38	12.9	13.9
ZG62A	7075-0	2.80	0.101	890-1180	—	—	13.1	14.4
	7075-T6	2.80	0.101	890-1180	30	0.29	13.1	14.4

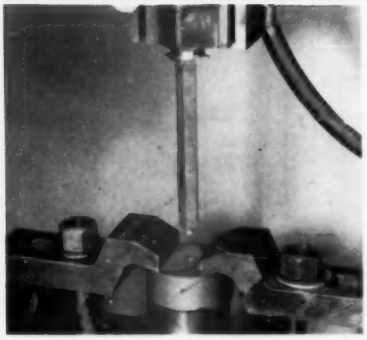
Data from Reynolds Metal Co.

(1) Percent of international annealed copper standard.

(2) Calories per sec., per sq. cm., per cm thickness, per deg. centigrade.

(3) Inches per inch.

1. **TOOLING** seen here: Carbide compacting die and locating shanks which are one-inch square.



1A. **BEFORE ELOXING,** the carbide nib is seen over the coolant-well in the Elox M-500 machine tool. Cutting time: 1 hr.

Here's one way to . . .

Cut Those Expensive Mold

by **THOMAS G. LARKINS***

ELECTRICAL discharge machinery, a precise and cost-saving metal-working machine tool, is simple to use and easy to understand. And, it is less costly.

Through proper electrical circuitry, a series of low voltage, high frequency discharges occur between an electrode and the work piece. These discharges have a frequency from about 10,000 to several million per second.

They effectively erode the work piece in a shape that is the exact reverse of the electrode. Advance of the electrode through the work is controlled by a servo mechanism. Machine operator time is used only for set-up and start of the work with occasional inspection. Labor costs are, therefore, reduced by about 75%.

Electrode materials can be almost any conducting material. Some of the most popular are brass, copper-tungsten, carbon or graphite, and Elo-Met (a proprietary zinc-tin alloy).

Electrodes may be formed by any desired method. Since most electrodes are of soft, easily machined material they can be made quickly and economically. Accuracy is of prime importance since the hole made by the machine will be no more accurate than the tool used to cut it.

Both through-hole and blind-hole cavities can be made by this die sinking method. A typical through-hole die is shown in figure 1. This is a compacting die for powder metallurgy work, made in 55A cemented carbide. Specifications for this die required no taper on the sides and tolerances no greater than $\pm 0.0001''$, and sharp corners. The electrode used was copper-tungsten brazed to a brass shank.

The tool was machined to tolerances of $\pm 0.0005''$. A presintered blank with a $0.125''$ diameter hole was used. The die is $1''$ deep and required 1 hour to finish. The only other possible method of making this die was in sections, by grinding the carbide.

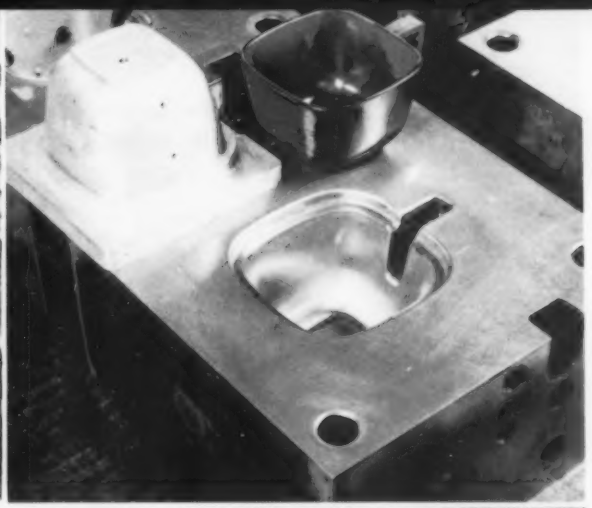
Another example of an "Eloxed" die is shown in figure 2. This is a die-casting die for the production of aluminum die castings. Originally a die for casting zinc had been made. This original was used as a master and Elo-Met electrodes were pressure cast in it.

With these electrodes, all of the cavities shown in the die block were sunk in a total of 240 hours. Mechanical machining methods would have required at least 1000 hours for the same job.

When multiple cavities are required and no master is available, one technique is to make an aluminum master male form. From this, plaster molds are made into which electrodes can be cast. As many electrodes and cavities as are required can thus be made easily and inexpensively.

*ELOX CORP. OF MICHIGAN

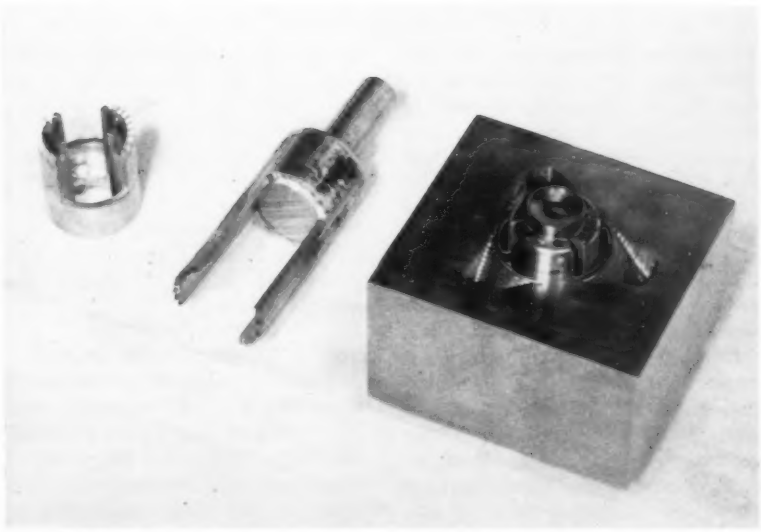
2. HORN DIE as produced on Elox equipment by Gelasco Tool and Die, Bridgman, Michigan. A saving of 75% in time and labor costs was made possible by electrical-discharge machining of this die.



3. ELECTRODE, cup, and the resultant part. Eloxing removed .08" of stock from the hardened molds.

3A. CUP MOLD set up in the Elox M-501 machine tools, showing electrode attached to the precision electrode-holder. Design changes in the hardened die were made without annealing.

and Die Tooling Costs!



4. TOOLS, left to right, the antennae spacer, the electrode, and the die.

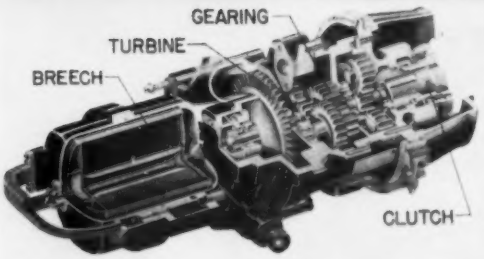
Die changing after the die has been hardened is another field where electric discharge is a valuable tool. The cup die shown in figure 3 required a change in lip design. The block had been hardened to 58R_c-60R_c. A total of 0.080" of metal had to be removed. With an Eloxing machine and a properly shaped electrode the job was done in 15 hours. No annealing, no machining and no rehardening of the block were required.

A final example is shown in figure 4. This is a zinc die casting die for an antennae spacer part. Fourteen cavities were required and these were made in eight hours per cavity. The only other practical method of making the cavities was by hobbing in a soft steel, finish machine, harden and then polish.

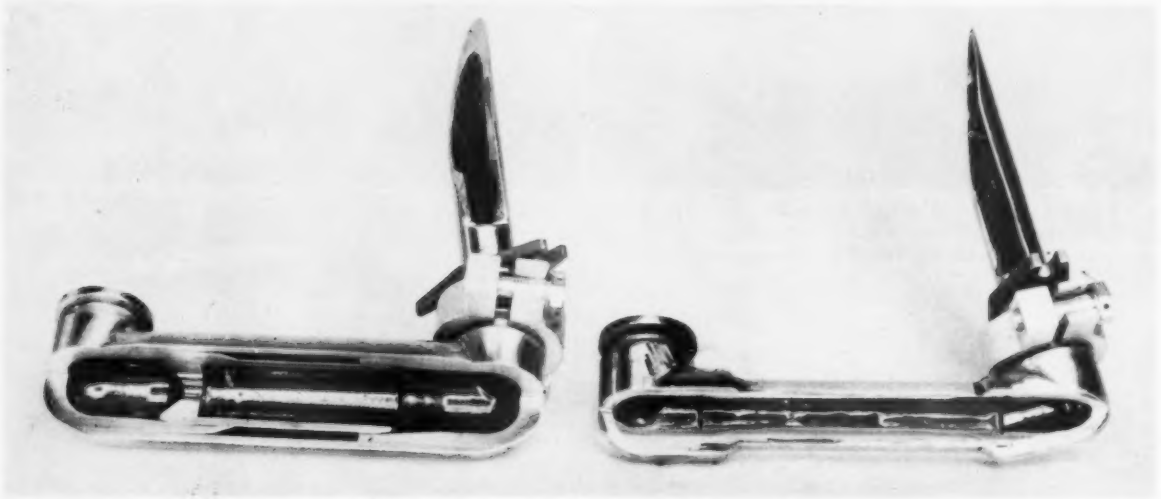
With electrical discharge methods the cavities were cut in prehardened VDC die steel in much less time.

Even if made by hobbing, a parting line at die segments would have been evident and a separate finishing operation on the castings required. The die made by Eloxing showed no parting line and thus a finishing operation was saved, reducing the cost of the castings.

This die-making method is one of the most recent cost-savers.



1. STARTER is seen here in cutaway.



2. TOLERANCES WITHOUT MACHINING are possible, only in the investment cast part at the right. The fabricated part seen at left was rejected because thermal stresses and varying thicknesses of metal may cause cracking as it conducts 1500°F exhaust-gases from the turbine wheel.

Investment Castings for Jet Engine Starters

By FRANK W. FERNALD*

IN designing the AS-12 solid propellent starter and the AS-18 air combustion starter, there was little experience to draw on.

A modern aircraft starter must put out 100 hp. to 200 hp. for about 10 seconds. Turbine wheels rotate up to 50,000 rpm and each starter must have a life of about 500 starts or a total life of under two hours. The starters must be designed for minimum cost and weight.

Many manufacturing methods were considered for the various components and investment castings selected for some of these reasons seen in table I.

A typical starter is shown in figure 1. Parts from this starter illustrate all of the four points noted above.

COMPLEX CONTOURS IN HARD-TO-MACHINE MATERIALS

To get good life and proper operation the turbine-wheel, buckets had to have good high-temperature strength, stability, and resistance to erosion.

Only a high cobalt-base alloy of the Stellite type would do. This material is almost impossible to machine by any method except grinding. To obtain satisfactory turbine performance, close tolerances were required in the airfoil section of the bucket.

The only fabricating method that could meet the tolerance requirements in Stellite was investment casting. As-cast, the dimensional accuracy and surface finish of the airfoil sections was satisfactory. The only machining required was straight grinding on two sides of the bucket shroud bands.

Another part, also of stellite for high-temperature strength, that was most economically investment cast was the turbine nozzle, figure 4. This part conducted gases at temperatures above 2000° F. Design and life-requirements were the same as for the turbine buckets.

Stellite was again selected as the only material which would give satisfactory life. No machining was required in the converging and diverging portions of the nozzle. The base of the nozzle was ground flat where it joined to the hot gas connector.

MINIMUM COSTS FOR COMPLICATED SHAPES

The gear cage of the starter is an example of this type of part. The material had to have reasonably high mechanical properties to meet operating stresses with minimum weight. Close tolerances on normally unmachined areas of the castings were required to meet space envelope limits.

A prototype case was machined from high alloy steel bar stock. Mechanically it met the requirements but production costs were

*MANAGER, MFG. ADMINISTRATION, MISSILE & ORDNANCE SYSTEMS, GENERAL ELECTRIC CO.

3. NO LOSS IN BALANCE occurs when this turbine wheel, fitted with investment-cast buckets, turns at 50,000 RPM's. A simple change in the pattern allowed coring the hole.

TABLE I

Reasons Why Investment Castings Are Used

1. Ability to produce intricate shapes in hard-to-machine materials.
2. Minimum costs for complicated shapes by reducing machining costs.
3. Combination of several parts into one casting.
4. Use of holes or recessed areas to reduce weight.

4. STELLITE TURBINE NOZZLE has great strength at high temperatures. This investment casting conducts gases heated to more than 2000°F. Stellite is the only useable material.

far too high. Sand castings could not produce the required properties. Two-piece forging design required over-all machining.

An investment casting design and pattern were worked out in which the only machining was on the bore which held the bearing and the output shaft. The cost of the investment casting was half the cost of two forgings.

Another example of a low cost, complex part is shown in figure 2. This part conducted exhaust gases at temperatures approaching 1500° F away from the turbine wheel. Stainless steel was satisfactory for a strength and corrosion resistance.

Close tolerances were required because the cross-section of the exhaust pipe had to be an airfoil section and also because the cross-section of the exhaust pipe was critical.

A fabricated design was rejected because of excessive welding which would have made the part liable to cracking due to thermal stresses and varying metal thicknesses. A casting was, therefore, indicated and only an investment casting could produce the required tolerances without excessive machining.

COMBINATION OF PARTS

The cartridge starter connector must conduct hot gases above 2000°F from the breech to the turbine wheel. The original design used three investment castings and high-temperature tubing parts, welded together into a single assembly. Service experience with this assembly showed that a more durable part was needed.

Welds failed due to thermal shock and vibration.

A new design was developed: *A one piece investment casting.*

The service life was doubled and the cost was a lot lower.

HOLES OR RECESSES TO REDUCE WEIGHT

In the aircraft industry, weight is extremely important. Generally, it is not economical to reduce weight by machining. The turbine wheel in figure 3 is an example. The recesses in the outer ends of the buckets provide an over-all weight reduction of about 30%. The buckets, with the hole, are plenty strong and there is the added advantage of a constant cross-section of the airfoil along the length of the bucket; this improves the operation.

The holes could not be machined economically, but a simple change in the bucket wheel pattern allowed coring the hole; and there was no increased cost. The investment casting process was able to core these holes with sufficient accuracy so that there is no loss in balance when the wheel rotates at 50,000 rpm.

Cut parts costs by specifying . . .

Realistic Tolerances For Sinterings

by ROBERT BURGESS*

ONE of the most important factors in the cost of sinterings, about which there are many misconceptions, is tolerances.

If the designer or engineer is aware of the degree of tolerance which can be maintained on sinterings and carefully analyzes the part under consideration with this in mind, the problem becomes simpler and the cost may be lowered. In general, the closer the tolerance, the higher the cost.

Tolerances closer than those which can normally be held on a sintering, without sizing, affect costs in the following manner:

1. Raw materials—Material selection is very important and can result in higher costs when optimum uniformity is desired. These materials are necessary in close tolerance work.
2. Powder mixing—To insure optimum uniformity of the blended powders requires extra care. Again, uniformity is necessary when producing close tolerance parts.
3. Compacting or pressing—Axial length and parallelism of upper and lower faces can vary considerably. The tighter the tolerance, the slower the pressing cycle required. Diameter or radial tolerances can be affected by press speed but tooling is usually the limiting factor. Close tolerances require better tools and thus tool costs are higher. As tolerances become tighter, inspection and handling costs at the compacting operation increase, due to more rigid inspection and possibility of damage to fragile compacts. Closer control of the compacting press is also necessary.
4. Sintering is an extremely critical phase of the process and dimensional control is highly sensitive to sintering conditions. Closer tolerance work usually requires a slower sintering speed in order to allow more uniform heating. Higher cost sintering atmospheres and higher flow rates can be helpful.
5. Inspection and handling costs after sintering are increased due to the need for more critical inspection.
6. If heat treating is specified, this creates a further tolerance control problem, since heat treating can alter dimensions considerably.

In order to obtain the lowest cost per part, the chart (Table I) can be used as a guide when considering tolerances that can be maintained under normal operating conditions and without sizing.

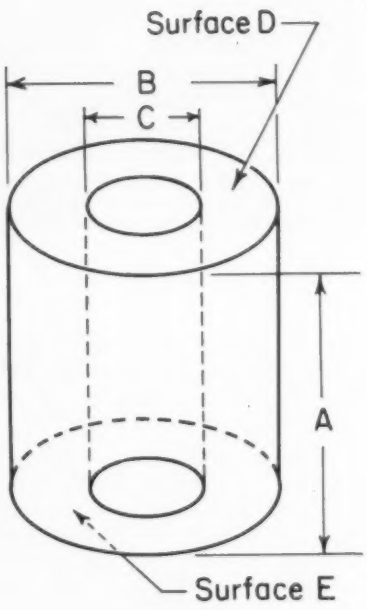


TABLE I

Dimension "A"	
Up to 1/4"	±.003
1/4" to 1"	±.004
1" to 2"	±.006
2" to 3"	±.007

Dimension "B" & "C"	
Up to 1"	±.001
Over 1"	±.001/in.

Concentricity (T.I.R.) "B" & "C"	
When "B" is 1"	.003
1" - 2"	.004
2" - 3"	.005
Over 3"	.006

*BURGESS-NORTON MFG. CO.

To obtain the tolerances as shown in Table II, closer and costlier controls would be necessary, but sizing would not be required.

TABLE II

Dimension "A"	
Up to ¼"	±.001
¼" to 1"	±.002
1" to 2"	±.003
2" to 3"	±.004

Dimension "B" & "C"	
Up to ¼"	±.0005
¼" to ½"	±.00075
½" to 1"	±.001
Over 1"	±.001/in.

Concentricity of "B" & "C"	
When "B" is 1"	.0015
½"	.0025
Over 2"	.003

Note 1: Out-of-roundness depends on wall thickness. Thin-walled parts tend to distort more than thick-walled parts. This tolerance can be held to .001 maximum on parts over ¼" wall thickness.

Note 2: Flatness depends on length of "B". Surface "D" and "E" can be flat .002 maximum on parts over ¼" thick.

Note 3: Parallelism of surfaces "D" and "E" can be held to .004 maximum on most all parts.

To maintain tolerances closer than those outlined in Table II would require one of the following or a combination:

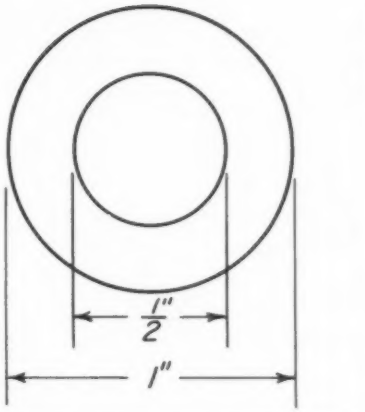
1. Sizing
2. Secondary machining
3. Grinding

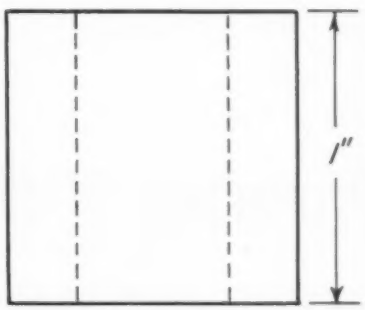
Sizing will improve diameter and out-of-round tolerances to about .001 maximum on many materials. High carbon steels are more difficult to improve because of less compressibility.

Machining and grinding tolerances depend on equipment and operator. The same tolerance can be maintained as on conventional materials.

To illustrate the effect on the cost of tolerances, the following example can be used: (sketch above)

With these specifications the full rate of production of compacting and sintering equipment could be utilized. Minimum inspection would be required. Tolerances would be as in Table I. Estimated





CONCENTRICITY O.D. to I.D.	.003 TIR
OUT-OF-ROUND	.001 TIR
ENDS FLAT	.002 TIR
ENDS PARALLEL	.004 TIR

cost per piece—100 units

To achieve tolerances as in Table II, the closer controls previously outlined would be used. Estimated cost per piece—120 units

By imposing a restriction on the length dimension so that the tolerance is reduced to ± .001, the compacting cycle and sintering load is reduced and inspection is increased. Estimated cost per piece—140 units

If a restriction is placed on the O.D. and I.D. dimensions so that the tolerances are reduced to ± .001 and ± .0005 respectively and the length tolerance is normal, then a sizing operation could be employed after normal compacting and sintering. Estimated cost per piece—150 units

If the tolerances on any dimensions are reduced beyond the limits of the sintered metal process, then it would be necessary to perform a secondary operation such as grinding. This would substantially increase the cost of the part.

It must be remembered that the foregoing should be used only as a guide and that each individual application must be studied by the customer and discussed with his supplier.

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Circle No. 4 on the Reader Service Card

Wider use of sinterings will come with increased data which the design engineer can safely apply. Here are realistic. . . .

Design Properties Of Sinterings

Part I — Non-ferrous alloys

ONE of the problems that has plagued the designer has been the lack of correlation between published mechanical and physical properties and those developed in the molded part.

It is well known that test bar results should never be used for design of castings until the relationship between these results and actual casting properties are established. This same caution must be exercised when designing with sinterings.

However, some custom fabricators of sinterings now feel that they have established this relationship between test bar properties and molded properties well enough so that minimum physical and mechanical properties can be published and these results safely utilized in designing for sinterings.

If experience with these published properties bears out this contention, as it most probably will, a great forward step will have been taken by the powder metallurgy industry.

Many properties remain to be established so that the design engineer will have data available that is comparable with that now published for wrought materials. Among the needed data are: Thermal and electrical conductivity (or resistance), corrosion resistance to the more common atmospheres, thermal expansion over the useable working range of temperatures, sub-zero properties of all kinds, elevated temperature properties of all kinds, impact strength, ultimate strength and yield strength in compression, hardness, wear resistance, ductility, and a few others.

The metal powder industry, through its trade associations and in cooperation with ASTM is actively engaged in the establishment of these values. As rapidly as these standards, or minimum values, are established they will be published by PRECISION METAL MOLDING.

Companies who have contributed material for the tabulation given on the next two pages (non-ferrous alloys) and the data to be given next month (ferrous alloys) are designated by code numbers. These code numbers with the correct company name are:

1. Arrow Sintered Products Co.
2. Brockway Pressed Metals, Inc.
3. The Bunting Brass and Bronze Co.
4. Ceromet, Inc.
5. Dixon Sintaloy, Inc.
6. The Ford Motor Co.
7. International Powder Metallurgy Co.
8. Keystone Carbon Co.
9. Kwikset Powdered Metal Products
10. Norwalk Powdered Metals, Inc.
11. P. R. Mallory & Co.
12. Pacific Sintered Metals Co.
13. Powdercraft Corp.
14. The Presmet Corp.
15. Pyroferric Co., Inc.
16. The United States Graphite Co.
17. Globe Supermet

Part II—Ferrous alloys will be published next month.

Copper Base

TYPICAL PROPERTIES OF SINTERINGS FOR DESIGN USE

Manufacturer				Composition: Percentages of:									Properties				
Code	Designation	ASTM	SAE	Fe	Cu	C	Sn	Zn	Ni	Sb	Pb	P	Density grams per cc	Ultimate Tensile PSI	Elongation in percent of inches	Rockwell Hardness	Yield in Comps.*
1	AB-9010				90		10						6.4-6.8	12-16,000			
2	Basic R	Type I, Class A			90		10						6.4		2.0	H-50	
3	Bronze Bearings	B202 Type I Class A	Type I, Class A		90		10						Bearing Stock, consult the manufacturer				
3	Bronze Bearings	B255 Structural Grade	Type I, Class A		90		10						Bearing Stock, consult the manufacturer				
4	Brass				80			20									
4	Brass				90			10									
4	Bronze				90		10										
5	Z-901 Brass				90			10					7.5-8.0	20-28,000	8.0-15.0		
5	Z-802 Pb Brass		Type 4 Class A, Class B		78			20			1.5		7.5-8.0	27-34,000	10.0-18.0		
5	BB-901 Bronze	B202-55T	Type I, Class A		88	1.75	10						6.4-6.8	18,000			
5	BB-906 Leaded Bronze	B202-55T	Type I, Class B		86	1.5	10				2		6.8-7.2	18,000			
5	EC-100				100								7.5-8.3	17-34,000	6.0-15.0		
5	N-6418 Nickel-Silver				64			18	18				7.3-7.8	19-35,000	5.0-11.0		
6	PC-91				89.5	0.5	10						6.4-6.8	13,000			
7	Br 901				90		10						6.2	15,000			13,000
7	BZ 901				90			10					8.0	26,000			34,000
7	BZ 802				80			20					7.8	30,000			
7	NS 185				64			18	18				7.8	40,000			
7	BR 652			25	68		7						6.2	16,000			15,000
7	GB-3				87	3	10						6.5	10,000			8,000
8	C-64 Bronze	B202-55T Type I, Class A	Type I, Class A		87.5 90.5	1.75 Max	9.5 10.5						6.2-6.6	15,000	2.5	H-50	16,500
8	C-64HD Bronze	B255-54T Class B			87.5 90.5	1.75 Max	9.5 10.5						7.0-Min	20,000	3.0	H-80	28,000
8	V-1 Brass	B882-55T Class A		.25 Max	77 80		0.1 Max	Bal	0.1 Max	0.1 Max	1 2		7.2-7.7	21,000	12.0	H-70	12,000
8	VI-HD Brass	B287-53T Class B		.25 Max	77 80		0.1 Max	Bal	0.1 Max	0.1 Max	1 2		7.8-Min	28,000	6.0	H-89	21,000
8	V3 Nickel Silver				64			18	18				7.5-7.9	32,000	10.0	H-92	18,000
9	K-101-A				100								7.0-8.0	7-17,000	2.0-8.0	H-28-70	
9	K-101-R				100								8.0-8.4	16-25,000	6.0-14.0	H-51-75	
9	K-111-A				78.5			20			1.5		6.7-8.0	13-28,000	7.0-12.0	H-34-87	
9	K-111-R				78.5			20			1.5		7.66-8.05	28-32,000	20.0-27.0	E-35-50	
9	K-111-F				78.5			20			1.5		7.89-8.18	28-39,000	3.0-4.0	E-69-86	
9	K-113				90			10					7.2-7.8	17-25,000	9.0-17.0	H-38-72	

Copper Base—cont.

TYPICAL PROPERTIES OF SINTERINGS FOR DESIGN USE

Manufacturer				Composition: Percentages of:									Properties				
Code	Designation	ASTM	SAE	Fe	Cu	C	Sn	Zn	Ni	Sb	Pb	P	Density grams per cc	Ultimate Tensile PSI	Elongation in percent of inches	Rockwell Hardness	Yield in Comps.*
9	K-121				64			18	18				6.26-7.99	12-32,000	2.0-8.0	H-39-94	
9	K-131-A				90		10						5.79-6.76	12-20,000	6.0-12.0	H-18-50	
9	K-131-F				90		10						6.58-7.90	20-34,000	3.0-4.0	H-30-60	
9	K-302-B					Same as AISI 302B Stainless Steel							6.4-6.95	32-54,000	3.0-12.0	K-28-82	
9	K-304					Same as AISI 304 Stainless Steel							6.55-6.95	50-62,000	4.0-12.0	K-44-83	
9	K-316					Same as AISI 316 Stainless Steel							6.5-6.95	49-65,000	45.0-26.8	K-42-82	
10					100								6.5-8.3	10-30,000		To B-30	
10					Bal			10				0.5	6.5-8.2	10-38,000		To B-35	
10					Bal			20			1.5		6.5-8.0	5-25,000		To 50	
10					Bal		10						6.0-8.0	5-18,000		To 50	
10					Bal	1	10						6.0-8.0	5-18,000		To 50	
12	M-111 Brass				78.5			20			1.5		7.2	20,500	10.0	H-68	
12	M-114 Brass				78.5			20			1.5		7.9	31,000	24.0	E-41	
12	M-121 Bronze				90		10						6.4	16,000	8.0	H-53	
12	M-123 Bronze				90		10						7.3	26,000	4.0	E-39	
12	M-131 Nickel Silver				64			18	18				7.4	22,000	6.0	H-92	
12	M-133 Nickel Silver				64			18	18				8.0	33,000	3.0	E-50	
13	PC-886 Nickel Silver				64			18	18				6.7	24,000	6.0		
13	PC-800 Bronze				87.5 90.5	1.5 Max	10.5 9.5	.75 Max	.35 Max	.25 Max			6.0	14,000	5.0 Min		
14	B-530				78.5			20			1.5			24,000	13.0	RH-50	
14	NS-010				64			18	18					32,000	15.0	RH-80	
14	B-810				90			8.5			1.5			16,500	10.0	RH-45	
14	CHB-01				90		10							15,000	2.0		
14	CHB-00				100									25,000	15.0		
16	400 Bronze **	B202-55T Type I, Class A	Type I Class A	1.0 Max	87.5 90.5	1.75% Max	9.5 10.5						6.4-6.8				
16	401 Bronze **	B202-55T Type I, Class B	Type I Class B	1.0 Max	82.6 88.5	1.75% Max	9.5 10.5	0.75 Max	0.35 Max	.25 Max	2.0 4.0		6.5-6.9				
16	406 Brass **	B282-53T Class A	Type 4 Class A	.25 Max	77 80		0.1 Max	Bal	0.1 Max	0.1 Max	1 2		7.2-7.7	16-21,000	8.0 10.0		
16	407 Brass **	B282-53T Class B	Type 4 Class B	.25 Max	77 80		0.1 Max	Bal	0.1 Max	0.1 Max	1 2		7.7-Min	21,000	10.0		
16	409 Bronze **	B255-54T Class A		1.0 Max	87.5 90.5	1.75 Max	9.5 10.5						6.4-6.8	13,500 16,000	1.0-2.0		
16	410 Bronze **	B255-54T Class B		1.0 Max	87.5 90.5	1.75 Max	9.5 10.5						6.8-7.2	16-20,000	2.0-3.0		

*0.1% offset PSI
**ASTM Standards, 1955 Edition, Composition and Mechanical Characteristics
**ASTM Standards, 1956 Supplement, Composition and Mechanical Characteristics

INCE

The Outlook for Zinc

APPARENTLY the total excess slab zinc stocks for the entire free world are in the United States. This was suggested by Charles R. Ince, vice president of the St. Joseph Lead Co., when he addressed members of the American Die Casting Institute in Chicago last month.

Ince said, "The United States has been the recipient of the surplus for the last several months due to the need for dollars in the exporting countries and the fear of an imminent increase in our tariff."

Ince also told the die casters that they might slip from first place in the list of zinc users. "You will note," he said, "that your industry has shown a more than average decline (see Table I) for the period at 34% as compared to 23% for overall consumption. Your main competitor, galvanizing, has declined only 13%."

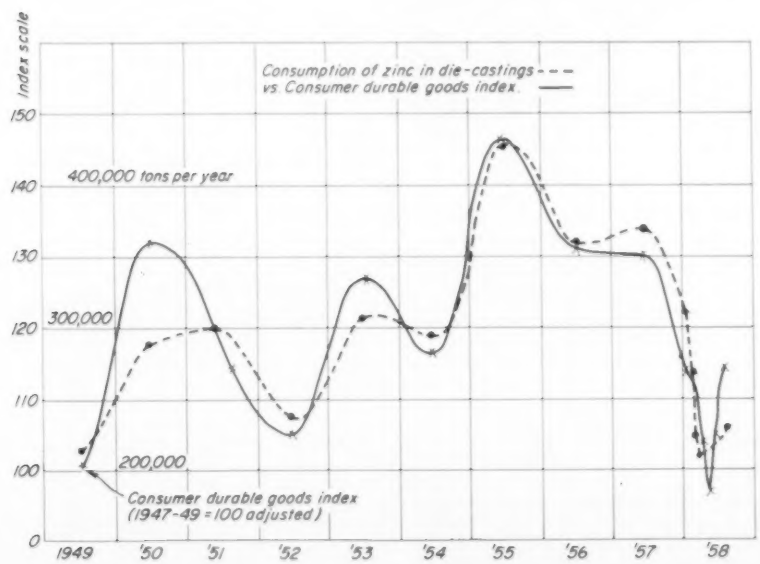
TABLE I
COMPARISON OF DOMESTIC ZINC SITUATION — FIRST FIVE MONTHS 1957-1958

	1958 May	1957 First 5 Mos. Avg.	1958 First 5 Mos. Avg.	Percent Change
Consumption	61,900	80,500	62,000	—23.0
Supply				
Smelter Production	71,000	94,500	72,800	—22.9
Metal Imports	11,900	25,000	14,000	—44.0
	82,900	119,500	86,800	—27.4
Surplus				
Monthly	21,000	39,000	24,800	
For the Period		195,000	124,000	
During the Period				
Refiners Stocks Changed	+19,500	+ 44,000	+ 74,000	
Consumers Stocks Changed	— 1,700	— 29,000	— 15,900	
To Govt. from Domestic Smelters	——	+102,000	+ 34,500	
To Govt. from Imports	+ 700	+ 50,200	+ 7,100	
Metal in transit, in warehouses	+ 2,500	+ 27,800	+ 24,300	
Consumption by Industries				
Galvanizing: Wire, pipe, etc.	15,079	17,500	13,930	—20.4
Sheet & Strip	15,856	14,159	13,476	— 4.8
Total	30,935	31,659	27,406	—13.4
Brass & Bronze	6,597	9,570	7,251	—24.2
Zinc-base Alloys	18,316	31,700	20,833	—34.2
Rolling Mills	2,896	3,540	3,038	—14.0
Oxide Plants	959	1,870	1,392	—25.6
Others	2,197	2,161	2,080	— 3.7
Total	61,900	80,500	62,000	—23.0

Ince went on to say, "The zinc market is in a very unfortunate state. There are large over-supplies of the metal; consumption is at a low ebb; prices have declined. The few statistics available do, however, indicate a small change for the better. Consumption appears up slightly; producers' stocks show their first decrease since last fall. This decrease, according to the American Zinc Institute, for August is 6000 tons, leaving a stock of all grades of 250,000 tons, or three and one-half months' supply at present rates of shipments. Of this stock, 86,000 tons are of special high grade, amounting to four months' supply.

"While the surplus this year," according to Ince, "is running less than last year, the significant difference is the fact that the federal government, through stockpiling or barter, took 152,000 tons of surplus during the first five months of last year. This compares with 42,000 tons taken off the market so far this year." He added that as of now, stockpiling and bartering have ceased. The surplus is backing up

continued on page 92



BAUMAN

Secondary Aluminum For Die Casting

THERE is one big untapped field waiting for penetration by aluminum die casters, according to George Baumann, General Manager of the Central Aluminum Department, at American Smelting and Refining Company's Federated Metals Division.

"That is the replacement of gray iron castings with aluminum," he pointed out in an address to members of the American Die Casting Institute at their annual meeting in Chicago last month.

"Aggressive pushing of new uses is going to pay off for aluminum die casters," he said. "The amount of gray iron castings just waiting to be replaced by aluminum permanent mold and die castings is fantastic!"

Another field available, according to Baumann, is the die casting of the new 20% to 25% silicon alloy, sometimes called the hypereutectic alloy. This has already been done successfully, and companies taking advantage of the development will benefit.

He pointed out that, "The market research staff of one of the large aluminum companies indicated an average of 14% more aluminum will be used in 1959 model cars."

Baumann emphasized that this, "Should mean a greater usage of die cast aluminum. The automobile industry itself," he continued, "now is talking in glowing terms of the prospects of next year, partly because of the improvement of the general economy and partly because it believes the lag in buying of the past few years may have built up a strong replacement market. We hear estimates all the way from five and quarter million cars up to some rosy idea of six million."

Other potential markets, according to Baumann, lie in die cast cylinder blocks, auto trim, and builder's hardware. "All this adds up to a growing market for 1959," Baumann predicted.

He criticized the primary aluminum sellers, however, saying "There are times when the scrap buying activities of the primaries hurt the secondary industry and its regular customers. The primaries, even today, with primary aluminum in plentiful supply, are pushing up the prices on certain grades of scrap. We see the, at times abnormal, purchasing activities of the primaries as threats to a healthy and vigorous secondary industry that has grown up with the die casters and has sensed and served their needs, sharing their mutual problems."

In his address, Baumann also outlined prices, saying, "Since 1956 secondary 380 ingot has been priced below primary 380 ingot, and since mid-1956 it has been below primary 2393 pig.

"The relationship today is: secondary 380 ingot sells at 22.00¢ compared to 26.40¢ for 2393 pig, and 29.00¢ for 380 primary ingot." He explained that this represents a saving of 4.4¢ per pound under primary 2393 pig, and 7¢ under primary 380 ingot.

According to Baumann, this re-

continued on page 93

Cast four *different* sizes, shapes, and types of products *all at the same time.* You can mix runs . . . one, two or three can be short runs, the rest long. New molds can be inserted in minutes to continue production . . . or just plug with blank inserts and continue long run. What's more, you get the same economy of operation running two or three units!

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WILMOT

Primary Aluminum For Die Casting

"THE nation's die casting industry faces a period of tremendous market growth. This should come in the automotive, tool, office equipment and appliance fields," Donovan Wilmot, vice president of Aluminum Co. of America told the American Die Casting Institute last month at the annual meeting in Chicago. "In the automotive field alone, new applications add up to about 800 million pounds of aluminum in a six million car-year."

"In 1955," Wilmot said, "the cry from government and industry was to increase the production of primary aluminum. Expansion was started, and by the end of 1955 capacity stood at 1,609,200 tons per year. But this wasn't enough. By the end of 1957 capacity had climbed another 14% and kept going so that by the end of 1958 productive capacity will be 2,080,000 tons, a 30% increase over 1955. Productive capacity is still being expanded so that a total of 2,604,500 tons per year will be reached."

Wilmot went on to say, "—as a result (of all this expansion) today, and for the foreseeable future, there is an abundant supply of primary aluminum for both the civilian economy and for military needs."

"One of the important effects on the die casting industry and aluminum fabricators generally is that the increased productive capacity has restored the price relationship between secondary and primary to a more normal basis."

"The chart (Figure 1) gives a monthly price comparison of primary pig (99.5%) and a secondary alloy—AXS-679. The black line represents the price of AXS-679. In September 1955 the price of primary pig was approximately 22.5¢ per pound with the secondary ingot over 30¢ per pound. Now, in 1958, this price situation is reversed. Secondary pig is constant at slightly under 22¢ while primary is about 24.7¢."

Wilmot said further, "The primary producers are well aware of the fact that the die casting industry usually depends upon the secondary smelters for its supplies of metal. Only when the price of secondary rises above the price of primary do the die casters buy their aluminum from us. While this is understandable, it is, of course, disappointing; particularly in light of the availability of primary metal."

"The only thing that the American aluminum industry has more of than metal is confidence in the future. Right now the need is for the present and we, at Alcoa, are working hard to develop new uses for aluminum in every form. Our budget for research and development activities in 1958 is about 18 million dollars."

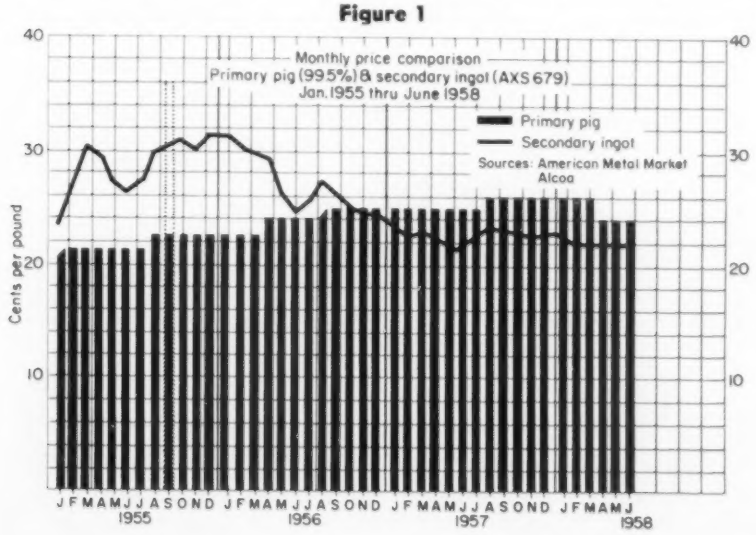
"I realize," Wilmot went on to say, "that you fellows are not engaged in the manufacture of end products such as automobiles, household appliances, etc. You cannot sell more parts for well-established aluminum applications to manufacturers of end products than are required for their production schedules. We all, however, can and should make every effort to increase the number of parts per unit which can justifiably be specified in aluminum.

"The aluminum brake drums on the 1958 Buick represent a technical advance which, I am certain, must be recognized by all automobile manufacturers."

Wilmot said, "There are many other possibilities in the automotive industry alone. The potential annual market for castings in new automotive applications adds up to 700 to 800 million pounds of aluminum in a 6-million-car year. This is close to one-fifth of the present available domestic primary capacity. Some of these applications are in the developmental stage, while others are close to commercial applications. Our own research and development people are attempting

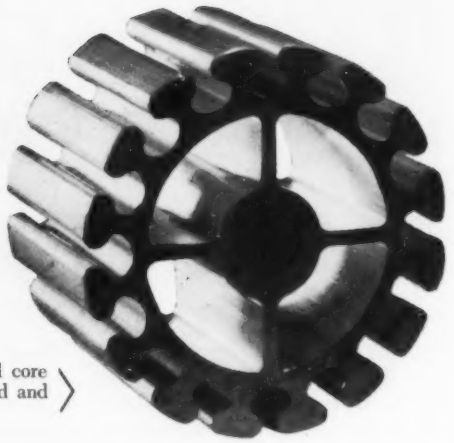
continued on page 93

Figure 1


Monthly price comparison
Primary pig (99.5%) & secondary ingot (AXS 679)
Jan. 1955 thru June 1958
Primary pig
Secondary ingot
Sources: American Metal Market
Alcoa
Cents per pound
40
30
20
10
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1955
1956
1957
1958

HOW TO USE EXTRUSIONS

Clever Use of Extrusion Cuts Manufacturer's Costs



CUT TO WIDTH desired, the extruded core is seen before the spindle-hole is bored and the piece faced.

NU-MATIC-Grinders, Inc., have an easy way to make cores for flexible-finger contact wheels. They cut rounds off an extrusion and get face-widths from one-inch to six-inches.

Their model 004 Flexcore is a non-inflatable, expanding-type contact wheel with an extruded core four-inches in diameter. The 6063-T6 aluminum alloy core, originally designed as an extrusion, was developed jointly by Nu-Matic and the Aluminum Company of America.

The extruded bars are delivered in random lengths of about six feet, and need only three machining operations:

1. Cut to length.
2. Face.
3. Bore a ⅜" or ¾" diameter spindle hole.

The core of the extrusion has near-perfect concentricity with the outside shape. After the spindle-hole is bored, the wheel has excellent balance. The folks at Nu-Matic say it happens rarely but, if necessary, concentricity is obtained with a light truing cut.

Normal running speeds for the contact wheel are 7000 RPM to 8000 RPM. However, tests show that bursting speed is over 35,000 RPM.

The rubber flexers are specially designed to fit keyed retaining slots. They are easily inserted into the core without special tools. Once in place, the fingers lock automatically, avoiding a need for retaining plates on each end of the core.

The finished contact wheels can be used individually or with an abrasive belt and backstand idler.

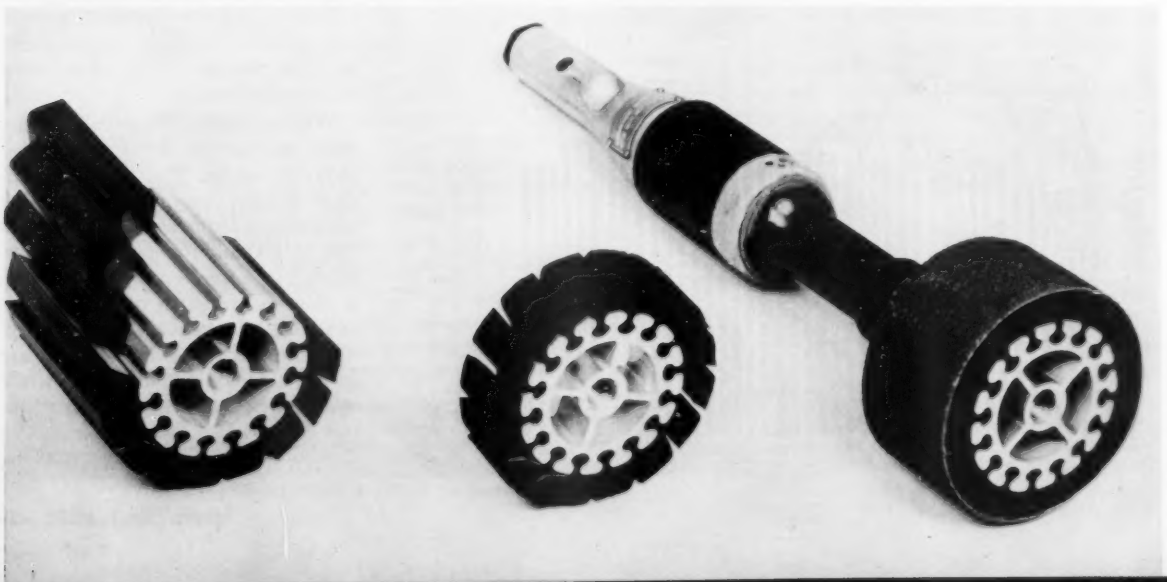
EXTRUDED CORE FEATURES

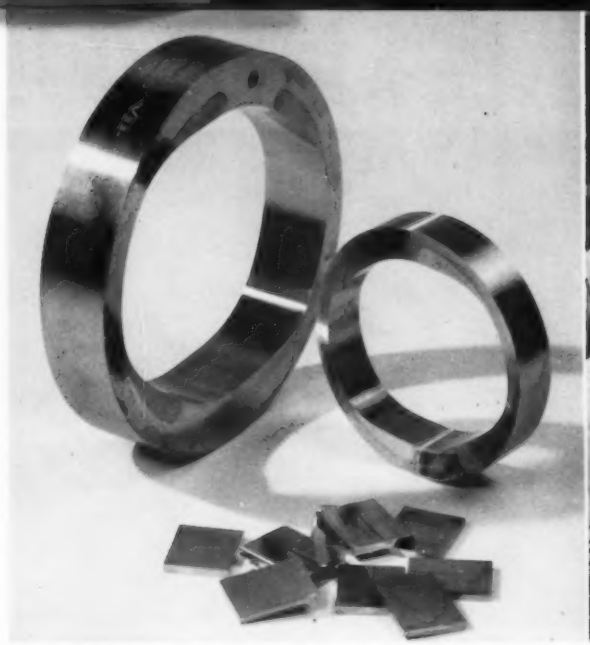
1. Cross-section is the same throughout the entire length.
2. Individual cores of any size can be cut to any size.
3. No extra machining is necessary to get cross-section shapes.
4. Assembly of flexible rubber fingers is easy.
5. Keyed retaining slots grip rubber fingers at high speeds.
6. Rubber fingers of simple shapes can be used.
7. Keeps balance at operating speeds without special machining.

SAVINGS TO BE NOTED IN USING EXTRUDED CORES

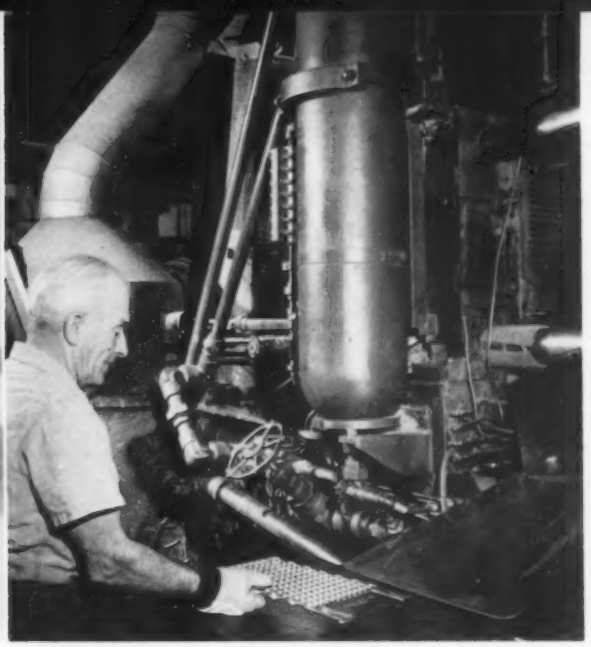
1. No more need to stock extra wheels. Wheel-hardness can be changed by inserting fingers of different Durometer hardness.
2. The aluminum core provides a considerable weight-saving because completed wheels weigh only 10 ounces per inch-of-width.
3. The wheel has low upkeep costs. Since each rubber flexer is a separate unit, damaged flexers are replaced one at a time, when necessary. At no time must the complete wheel be scrapped.

STEPS IN ASSEMBLY shows rubber fingers being inserted at left, completed wheel with extruded core in center, and the mounted wheel ready for use as an abrasive contact wheel at right.





NO CORROSION and only normal wear are evident on the ring and vanes of this pump after more than three years service in a synthetic hydraulic fluid.



MOLTEN METAL and hydraulic fluid are naturals for a serious fire unless a fire resistant fluid is used. This Exide plant has never had an hydraulic fire.

Advantages of Synthetic Hydraulic Fluids

By SAMUEL HAAS*

THE modern synthetic hydraulic fluids gained much of their initial attention because of their *fire resistance*. Many times they proved their value by not igniting when sprayed from broken, high pressure lines into open flames, furnaces, or pots of molten metal.

Recently engineering and maintenance men have become aware of other benefits of synthetic fluids. Some of these are: low maintenance, saving in make-up costs, and good efficiency over a very wide ambient temperature range.

It was this combination of assets which led lubrication and production engineers at the Philadelphia plant of the Electric Storage Battery Co. to install a fire-resistant fluid of the water-glycol type (Houghto-Safe 620, supplied by E. F. Hougton & Co.) in a production die casting machine. In this machine, hydraulic pressure is used to lock the machine and to inject the molten metal.

The machine at Exide is a 250 ton Reed-Prentice. It casts lead alloy grids for use in lead-acid storage batteries.

* MAINTENANCE ENGINEER, ELECTRIC STORAGE BATTERY CO.

This is not an unusual application. The fluids are in wide use in die casting machines because they must "rub shoulders" with open flames and molten metals. But this Exide plant has never been troubled with hydraulic fires. The economies of the water-glycol fluid were equally important in its acceptance for use.

The downtime involved in periodic changes of the hydraulic oil used in the die casting machine had to be cut. The oil oxidizes in service and sludge forms. Some sludge gets through the intake screens and into the rest of the hydraulic system.

This sludging took the machine out of production for a half day every 14 months. The result was a loss in production each time the change was made.

The water glycol fluid was installed in January, 1955, after an oil change and thorough flush as recommended by the supplier. At this time, the machine was two years old and operating with its original packings.

A packing changeover was not required as the water-glycol fluid is fully compatible with the original seals. These are still in use on the equipment.

During over three years of regular operation since the water-glycol fluid was first installed, about one quart of water make-up has been needed per month. No changes of the fluid have been needed nor has there been any other routine maintenance other than periodic viscosity checks.

A few weeks ago, the machine was shut down and the water-glycol fluid drained from the system so that field tests could be made on another fluid. For all practical purposes, the fluid was as stable as when it was first charged into the system in 1955.

There had been no significant oxidation and it was found that the dust which usually accumulates in a hydraulic reservoir was floating on top of the fluid. When dust settles through an oil medium, it acts as a catalyst in the formation of sludge. With water-glycol, however, clean fluid in the bottom of the reservoir was entering the intake screens at all times.

The Vickers low and high pressure combination hydraulic pump

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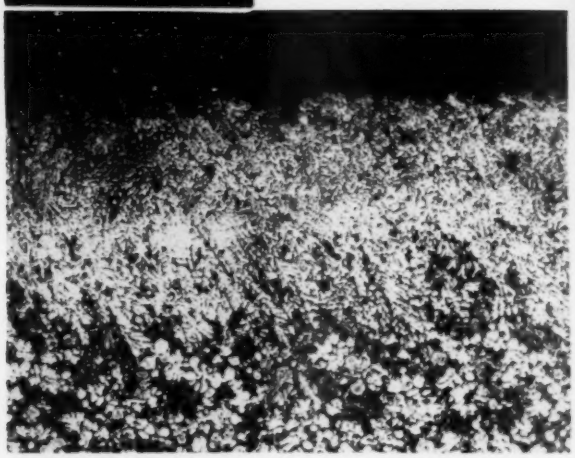
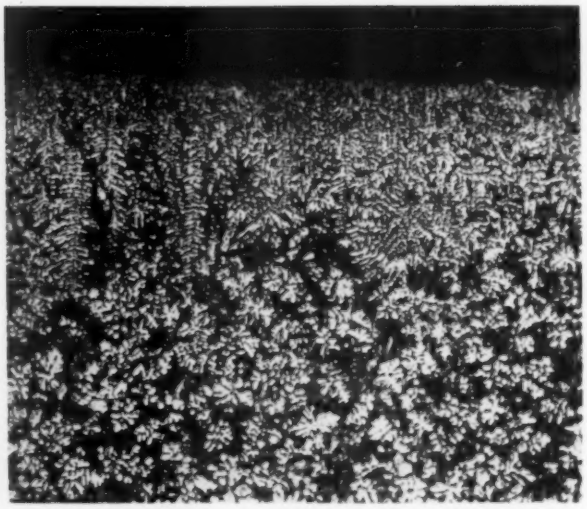
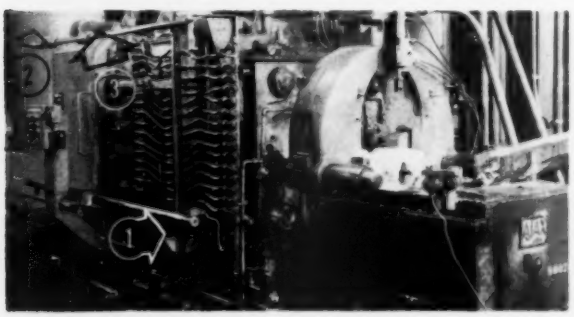


NON-VACUUM CASTING, skin thickness 0.024", note sub-surface porosity. Zinc alloy, nital etch, 200X. Reproduced full size.



VACUUM CASTING, skin thickness 0.022"-0.026", no sub-surface porosity. Zinc alloy, nital etch, 200X. Reproduced full size.



FULLY ENCLOSED by a hood when the machine is closed, the die cavity and shot sleeve can be completely evacuated.

SPECTOGRAPHIC ANALYSIS OF VACUUM MELTED CASTING

Element	Amount	Specification
AL —	4.42	3.5 — 4.3
Mg —	.04	.03 — .08
Cu — Less Than	.15	.15 — Max.
Fe — Less Than	.10	.10 — Max.
Pb — Less Than	.007	.007 — Max.
SN — Less Than	.005	.005 — Max.
Cd — Less Than	.005	.005 — Max.

Interim Report on Vacuum Die Casting

BY C. W. HODAN*

NECESSARY engineering changes can cause manufacturing difficulties that result in abnormally high scrap. This happened when changes were made in the design of the door casting, rear inner and outer lamps on the 1958 cars.

The change put the casting beyond the practical metal capacity, for a chromium finished part, of a 400 ton die casting machine. A thirteen pound shot was required. Production had to go to a 750 ton machine.

Preliminary investigation indicated that the installation of a Reed-Prentice Vacucast unit on a 400 ton machine would allow satisfactory production on the smaller machine. Installation of the vacuum equipment proved this was correct.

Prior to the use of vacuum die casting, the scrap rate of the rear lamp door castings was about 40%. After vacuum die casting was installed the reject rate dropped to between 15% and 25% and probably this will be lowered more as experience is gained.

Rejects were caused mostly by poor surface, blisters, and porosity. Also the skin thickness was variable so that more rejects developed during buffing and polishing. With vacuum die casting, these advantages were secured:

1. Improved surface finish on castings
2. Porosity reduced
3. Blisters reduced
4. Skin thickness increased and more uniform
5. Less injection pressure required allowing the use of a smaller (lower locking pressure) machine.
6. Die try-out and development time reduced.

Due to the improvement in items 1, 2, 3, and 4, the scrap rate during buffing and polishing operations was reduced.

Definite advantages seem to be gained in zinc die castings that require the elimination of fine surface imprefections. Lower costs in buffing and polishing operations also result when parts are vacuum cast. Where a commercial finish is required, such as for painted parts, the benefits are probably more than offset by the disadvantages that result from vacuum die casting. Some

*Supv., Mfg. Eng. Dept.
Ford Motor Co., Sandusky, O.

of these disadvantages are:

1. Preliminary results indicate that a minimum vacuum of 19″ Hg is required to obtain effective results from vacuum die casting. This requires frequent cleaning of the hood gasket.
2. The design of the die is fixed due to the rigid vacuum hood. Any die to be installed in the vacuum machine must be built, or rebuilt, to the required size.
3. Hydraulic core pulls are difficult, and expensive, to install without a special hood for each die.
4. Maintenance costs are higher because of the additional equipment.
5. Die set-up and removal is more difficult.
6. Vacuum pump and tank installation increase plant layout problems.
7. To comply with Ford Motor Co. safety standards, additional safety equipment must be installed on each machine.

The use of vacuum die casting does not eliminate the need for proper die design. Air vents may be left out, but otherwise die design is no different than that for non-vacuum operation.

While results on the vacuum die casting of zinc are still preliminary, results indicate that vacuum will be most effective on thin wall castings.

A group of these melting furnaces with their electrical control units, and the recording-indicating pyrometer, keep the temperature at a near-constant level.

This control is so exact that the temperature is held continuously constant within five degrees of the temperature-setting, usually kept at about 1300°F.

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fork	toggle
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holder	yoke

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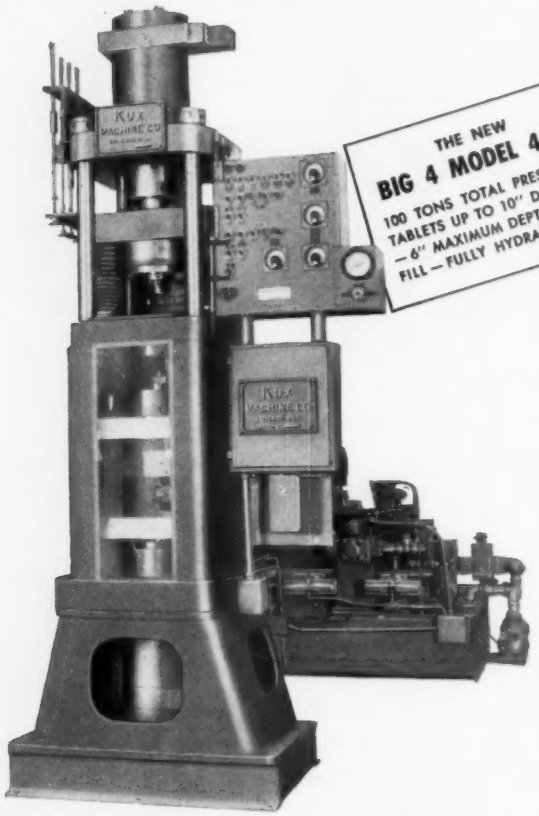

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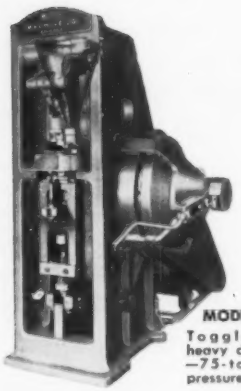
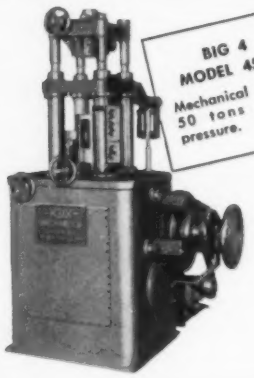
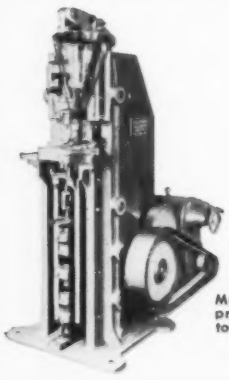
- **Push Button Control of Adjustments** — for upper punch penetration into die, and the die fill allows instant and accurate change of either setting, and scales show the exact position of the punches at all times.
- **Independent Secondary Lower Punch Mechanism Available** — hydraulically operated with separate timing and stroke control — can be used to apply pressure, to eject compact, or to move core rod up and down during filling or ejection sequence.



MODEL 65B
Toggle type heavy duty press —75-ton total pressure.



BIG 4 MODEL 450B
Mechanical press 50 tons total pressure.



MODEL 64
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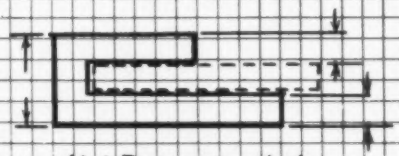
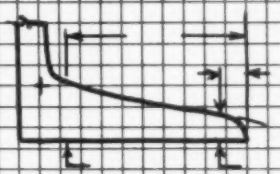
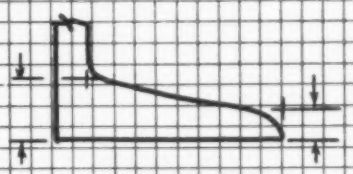


Not Recommended

Remember that the parts must be inspected. Give dimensions that make inspection simple and so that available tools and methods can be used.

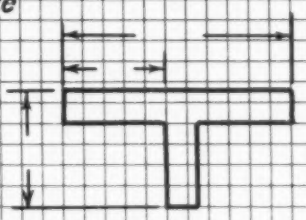


Recommended



Not Recommended

Avoid dimensions to imaginary points. They can not be checked easily. While useful for layout or construction they can cause error. Let the die designer figure the points of intersection.



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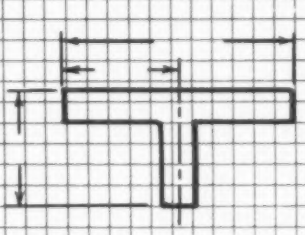
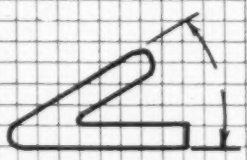
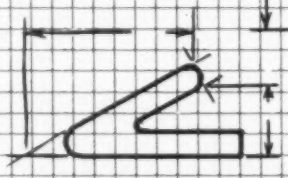


Not Recommended

Dimensions to center lines are not desirable. The centerline on an extrusion is indeterminate and increases difficulty of die construction & checking.

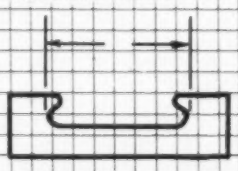


Recommended



Not Recommended

Specify angles and not offsets whenever possible. This makes die manufacture easier, inspection simpler and avoids calculation.



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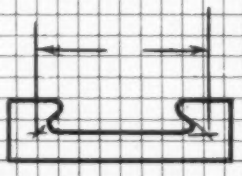
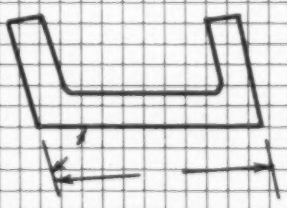


Not Recommended

Give dimensions tangent to radii. These are easily checked on the extruded material. When dimensions are given to intersect on points the measurement is indeterminate on the extrusion.



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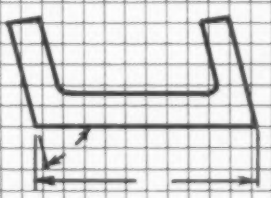

Not Recommended

Specify dimensions across parallel flat surfaces whenever possible. A sharp point is indeterminate and can not be located with any accuracy for either die making or checking.

Courtesy: Revere Copper & Brass, Inc.

PMM DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.

2. **Lubricating Problems?**—Bulletin 426 from Acheson Colloids Co. presents detailed information on how the company's line of dispersions may be the answer to your lubricating problem.

3. **Precision Die Castings**—"Your Doorway to Certified Zinc and Precision Aluminum Die Castings", is the title of a brochure describing the Advance Tool and Die Castings Co's. know-how in die casting design, engineering and production.

4. **Die Casting**—Design aid plus complete manufacturing facilities under one roof. Literature describes the company's know-how in producing your custom die casting. Ainsworth-Precision Castings Co.

11. **Dies & Related Tooling**—Complete facilities list and detailed information is available on dies, hydrotels, pantographs, rotary head mills and jig mills produced by Alliance Mold Co., Inc.

13. **Die Casting Trim Presses**—and die casting machines, that will meet your exacting requirements, are described in literature from B & T Machinery Co.

14. **Compacting Press** — Information and application data is available on a compacting press that is new in design and virtually eliminates raw material loss. Hamilton Div., Baldwin-Lima-Hamilton.

15. **Sintered Powder** — products; their composition, manufacture and application, are discussed in a 24-page engineering handbook from Bunting Brass & Bronze Co.

17. **Custom Alloys** — An engineering handbook for metallurgists published by Cannon-Muskegon Corp., gives complete data on their "Ultra-Met" and "MasterMet" alloy service.

18. **Barrel Finishing**—of metallic parts on a mass production basis, is the theme of a new booklet from The Carborundum Co.

19. **Small Die Casting Machines** — A brochure from Cast-Master, Inc. gives details and specifications on two die casting machines, the 7Z for zinc, tin and lead, and the 7A for aluminum, magnesium and brass.

20. **Investment Casting** — A descriptive brochure on the Minicast process of producing miniature precision metal parts is available from Casting Engineers, Inc.

22. **Die Casting Machines** — Bulletin 5246 from Cleveland Automatic Machine Co. gives specifications of 50, 200, 400 and 600 ton machines for zinc and aluminum die casting.

24. **Vacuum Plating** — Technical literature is available from Consolidated Electrodynamics on the subject "Why Plating With Vacuum is Easier and More Profitable". Information on the coaters, the lacquers, and the methods used, are included.

25. **Sprue Bushings** — sprue spreaders, ejector pins and cavity retainer sets are described in literature from Detroit Mold Engineering Co. Includes complete prices and specifications.

28. **Treating Aluminum Alloys** — Literature on coverals and highly efficient degassers, that eliminate pinhole porosity and oxides in aluminum castings and billets, is available from Foundry Services, Inc.

32. **Small Zinc**—die castings and injection molded tiny nylon (other plastic) parts are presented in two new brochures from Gries Reproducer Corp.

34. **Mold Materials** — Technical information is available on mold wash materials, ceramic molding media, shell molding minerals and other products of Harbison-Walker Refractories Company.

35. **Metal Powder Data** — A complete reference manual on metal powder raw materials is available from Charles Hardy, Inc.

36. **Zinc Die Casting Facts**—Henning Bros. & Smith, Inc. has issued a booklet entitled "Die Casting with Zinc Alloy". Explains the factors influencing production of sound castings and the causes of faults and defects.

37. **Dry Hearth Furnace**—Bulletin C-80 describes how aluminum is melted faster and better in the Hevi-Duty Electric Company's double-chamber dry hearth furnace.

38. **Sintering**—A 12-page brochure is available from Hoeganaes Sponge Iron Corp. that serves as an introduction to powder metallurgy benefits in metal parts production.

40. **Die Casting Machines** — Bulletin 5400-J from Hydraulic Press Mfg. Co. presents information on how their machines provide quality castings, better density control, uniform finishes and less scrap.

41. **Induction Melting Furnaces** — Bulletin 70, from Inductotherm Corporation, tells how Inducto furnaces give precise temperature control, controllable analysis, homogeneity and high melting speeds in melting steel alloys.

45. **Investment Materials** — and other related industrial products are presented in a complete catalog available from Kerr Manufacturing Co.

47. **Compacting Presses** — Hydraulic and mechanical models in capacities from 10 tons to 500 tons are presented in an illustrated catalog from Kux Machine Co.

48. **Wax Injectors** — Complete specifications and features of three models of all-hydraulic wax injection machines are available from Leyden Hydraulics, Inc.

49. **Induction Heating Data** — 36 illustrated pages, in the Lepel High Frequency Laboratories, Inc. catalog, gives information on the company's induction heating equipment.

51. **Die Casting Machines** — Information on a complete line of die casting machines is available from Lester-Phoenix, Inc. The units feature reliable clamping, and are readily adapted to vacuum casting.

56. **Split Thrust Bearings**—which save space and weight and hold against rotation and high thrust are presented in an illustrated folder and data sheet. National Molded Products, Inc.

57. **Metal Powder** — Technical data is available on Grade B-280 Plast-Iron powder. Plastic Metals Div., National-U.S. Radiator Corp.

59. **Brass & Nickel Silver** — powder metallurgy can save you money, is the theme of a new brochure of factual case histories from The New Jersey Zinc Co.

62. **Sinterings**—"How to Cut Precision Parts Cost with the Remet Powdered Metal Process" is the title of a brochure available from Reese Metal Products Corp.

63. **High Strength Powder** — Technical data is available on Type 6460 high strength powder that has minimum tensile strengths at 6.4 density of 60,000 p.s.i. as sintered, and 100,000 p.s.i. heat treated. Republic Steel Corp.

continued on page 74

PMM AT YOUR SERVICE

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THIS PLANT (USES) ☐ (PRODUCES) ☐ TYPES OF PARTS CHECKED BELOW:

- ☐ Die Castings
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- ☐ Investment Castings
- ☐ Powder Metal Parts
- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
- ☐ None of these

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OCTOBER, 1958. Do not use after 1-15-59

Name ..... *Position* .....

Company ..... *Kind of Business* .....

Street .....

City ..... *Zone* ..... *State* .....

Please send me information and literature on items circled below.

1	18	35	52	69	86	103	120	137	154	171	188	205	222	23v	256	273	290
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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Name ..... *Position* .....

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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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SUBSCRIPTIONS to PMM are free if you are 1) management, engineering or purchasing personnel in a plant that 2) produces or uses precision metal molded parts. Just fill out this order card COMPLETELY and mail it.

These two Reader Service cards will bring you copies of any literature offered or described in this issue. To use them:

1. Every ad and literature item has a key number. Circle the number(s) on the card that corresponds to the item you want more facts about.

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PMM Finishing Section

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

A job shop has to be ready to go into high production. See page 72.

Facts to consider when you're buying

Chromate Conversion Coatings

for Corrosion Protection, Paint Base, Decorative Finishing

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002″ max.) gel-like, complex chromate film of a nonporous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

If your company is manufacturing or buying parts or complete assemblies made from or plated with any of the more common non-ferrous metals—zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze—you've probably already run up against the question of finishing these surfaces with a chromate conversion coating. These coatings are used to protect against corrosion, or to provide a base for paint or to provide a decorative finish for sales appeal or shelf life. Since chromate conversion coatings represent a relatively new means of obtaining these finishes, this digest of facts to consider may be of value to you.

1. THE COATINGS THEMSELVES. There are many brands on the market. All are similar in many ways. Each, of course, offers its own specific advantages and these may relate to operating techniques, performance under actual use conditions, cost, availability, etc. Naturally, you'll want to choose a coating that is widely known and accepted under both military and civilian specifications.

2. THE COMPANY BEHIND THE PRODUCT. Is it a reliable, established organization? Does it offer experienced technical service, both from the field-engineering organization as well as the home office and laboratories? The man who sells and services your installation should be thoroughly familiar with not only chromate conversion coatings and their applications, but also with the characteristics and performance of related finishing operations such as precleaning, electroplating, painting, etc. This is most important since all steps of the finishing cycle must be functioning properly for the satisfactory performance of the ultimate finish produced.

3. AVAILABILITY OF THE PRODUCT. Ideally, of course, the material should be readily available to you from nearby warehouses to avoid time loss in long distance shipping and to provide emergency service, should the need arise.

4. COST. Naturally, the initial price of the material is important to you. However, just as you consider ultimate cost when you are buying mechanical equipment, ultimate cost must be considered for these finishing chemicals. So, it will pay you to investigate consumption costs, labor costs and the other factors which go into the determination of ultimate cost. Further, cost alone gives no indication of product performance, so careful attention must be given to the purpose the finish must serve and the value that finish will add to your product.

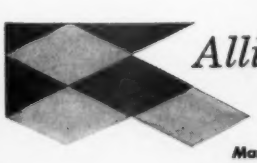
5. FACILITIES FOR RESEARCH AND DEVELOPMENT. Perhaps the existing types of chromate conversion coatings do not include a compound that will accomplish exactly what you wish. Then, it is important to deal with a supplier who has adequate research and development facilities available to work with you to produce a material to meet your needs. Naturally, such a project is seldom completed overnight. But, with complete cooperation and confidence from both you and your supplier, chances are a satisfactory program can be completed.

These are the concepts of sales and service on which we, Allied Research Products, Incorporated, have developed and marketed the line of Iridite chromate conversion coatings . . . superior product performance, complete sales and technical service, easy product availability, economical cost, extensive research and development facilities. No doubt you are familiar with our line and have seen this trademark—

IRIDITE®

—in our advertising, technical literature or on shipping containers in your plant. Remember this trademark when you're buying or investigating chromate conversion coatings for your company. It's your assurance of quality, economical products from a reliable and established company, skilled sales and technical service from both our home office and a national network of representatives, immediate availability from warehouses in strategic industrial areas and our willingness to work with you to develop new finishes to meet your needs, should the present line fall short.

For complete information on Iridite chromate conversion coatings, write today for your free copy of our technical data file. Or, for immediate advice, call in your Allied Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.



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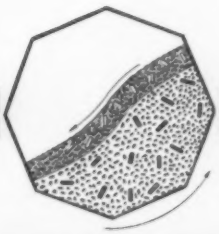
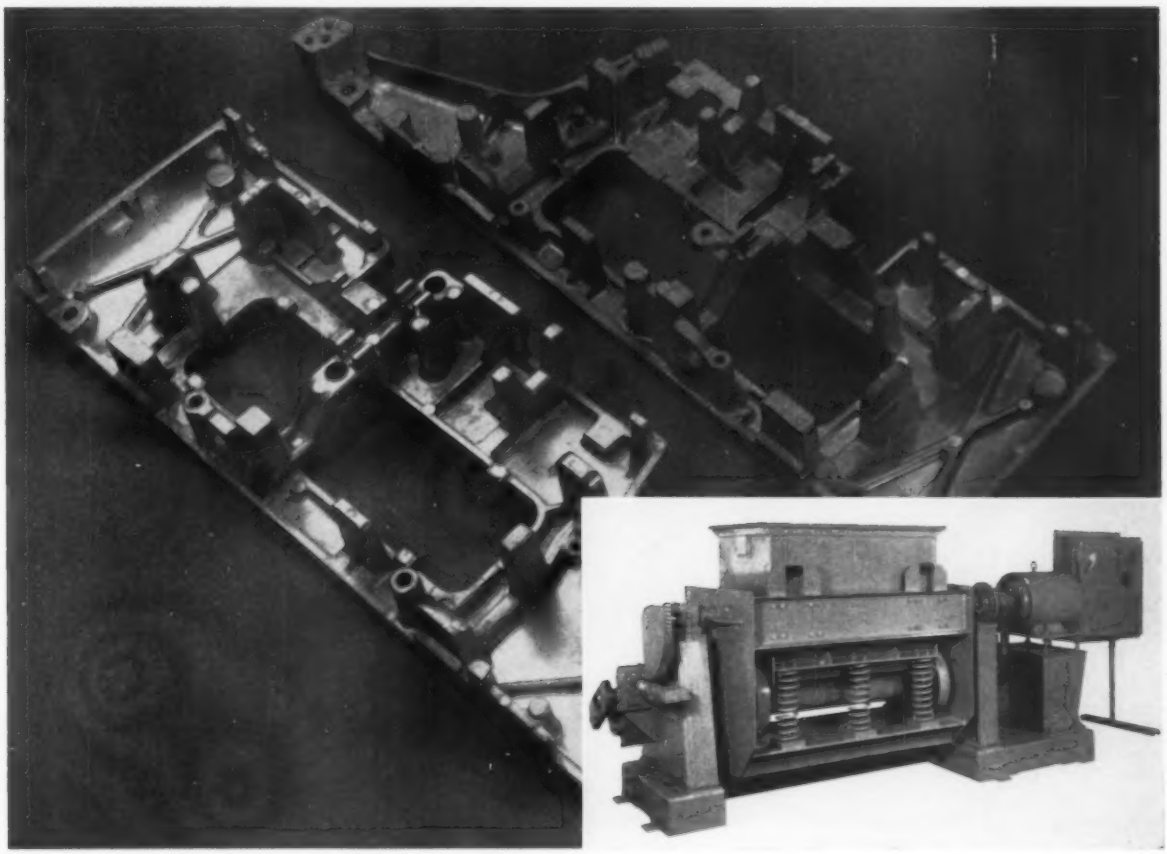
***Manufacturers of* IRIDITE®, IRILAC™, ARP® Brighteners and Plating Chemicals—West Coast Licensee: L. H. Butcher Co.**

For more information circle No. 73 on the Reader Service Card

INTRICATE DIE CAST parts are easily and quickly finished in the vibrating finisher (see inset). This part has numerous shielded areas and deep recesses. All parts are cleaned, deburred and radiused in a 5 min. cycle.





Vibratory Finishing

TWO of the problems in barrel finishing are precise control on very delicate work and reducing the cycle time. Vibration, either with or without normal rotation may be an answer.

Barrel finishing depends on the relative movement between the parts and the media. In the standard barrel the movement comes during the period when the parts and media move from the turnover point to the opposite side of the barrel. Little control can be held during this period.

Apparently, however, if the entire work load is vibrated, the sliding action can be more fully controlled by changing the frequency and the amplitude of the vibration. This control, when coupled with the proper difference in mass between part and media gives a high degree of process control.

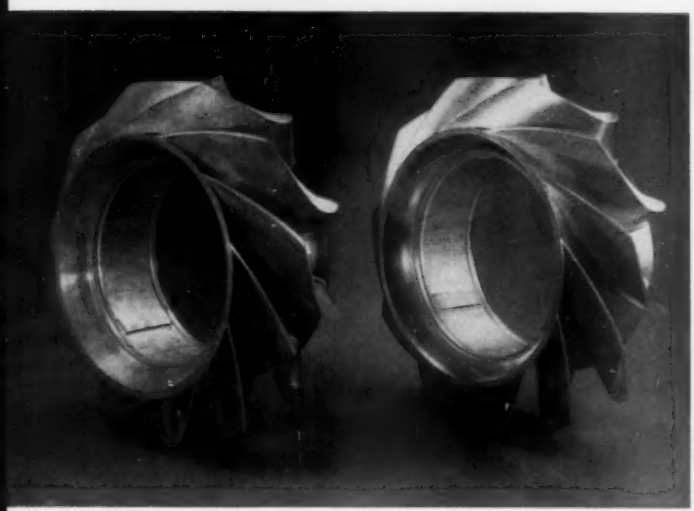
The addition of vibration to barrel finishing does more than improve process control. Experience shows that the time cycle for a job may be cut. In some cases this cut is to 1/10th to 1/100th the time required without vibration.

Another advantage of vibration is in finishing recesses, holes and guarded areas. Vibratory equipment finishes areas that could not be reached at all in rotating barrel machines.

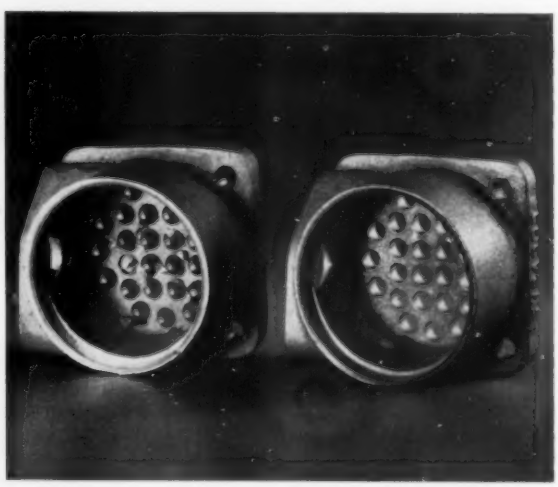
One of the newest vibrating finishing machines is the Lord Chemical Corp.'s vibrating barrel. Examples of work done in it are illustrated above and on the following page.

CONTINUOUS FINISHING is possible when large enough quantities are to be processed. These automobile steering parts are carbon steel extrusions continuously fed to and from a vibrator at the rate of 450 to 500 pieces per hour.

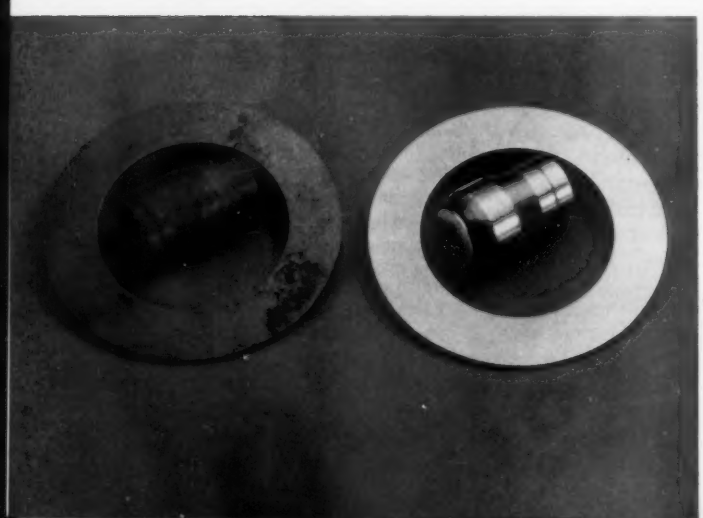
DEBURRING AND RADIUSING of small stampings is easily done. The parts shown required time cycles of from 15 to 30 minutes. Even very thin sheet metal parts can be handled with complete safety.



ZINC DIE CAST transmission parts. The parts have a burr on the trailing edge after machining. This burr was removed, leaving a sharp edge, in a five minute cycle in a vibrating finisher. Other surfaces are cleaned and radiused.



MACHINED CAST BRASS heat exchanger parts must be surface finished and deburred. All of the finishing action required is in shielded areas. For economical operation, the entire finishing job must be done in a single cycle.

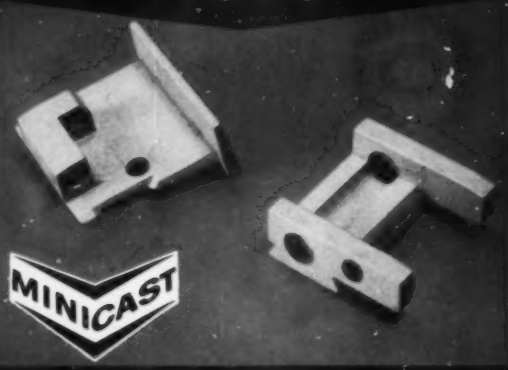


HEAT-TREATED stampings and forgings are quickly finished ready for plating in a vibrating finisher. Heat-treat scale, machine marks and burrs are removed in a single cycle in a fraction of the time required in a rotating barrel.

In all cases, part before finishing on left, after finishing on right.

The NEW Minicast Process

. . . produces miniature precision metal parts at less cost than those produced by other precision methods . . . at no sacrifice in quality



Only Pennies Per Part

■ The Minicast process is the unique, new precision forming process that successfully combines the basic advantages of the investment casting process with those of such other precision methods as coining, cold forming, screw machine production, and the like.

With Minicast, you get:

- metal parts in nearly all castable metals and alloys
- dimensional tolerances as close as plus/minus 0.001″ per inch.
- cross-sectional thickness as low as 0.020.
- exceptional surface finish.
- complex configurations.
- the economy of production runs up to 50,000 per day.

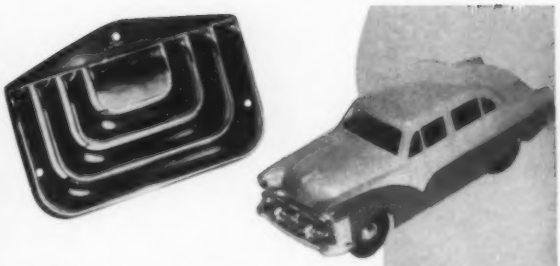
And, for the first time, the Minicast process gives you these features at *only pennies per part.*

Get the complete story . . .
Write for this new descriptive brochure . . .
It's free of course.

ENGINEERED PRECISION CASTINGS

Casting Engineers, Inc.
2323 NORTH BOSWORTH AVENUE
CHICAGO 14, ILLINOIS

For more information circle No. 20 on the Reader Service Card



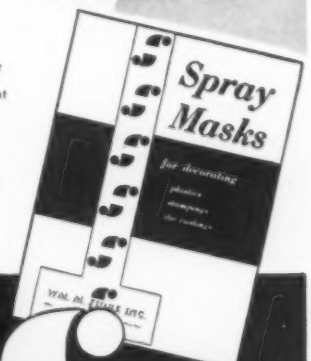
FIORE MASKS FOR PRECISION PAINTING

Spray decorating methods have improved so rapidly in recent years that you may not be aware of some time-saving, money-saving techniques now available. Today, special Fiore designed spray masks and fixture devices make possible single or multi-color decoration with precise registration on irregularly contoured products.

IF { your product is judged on appearance
you want best possible results
you want a minimum of rejections }

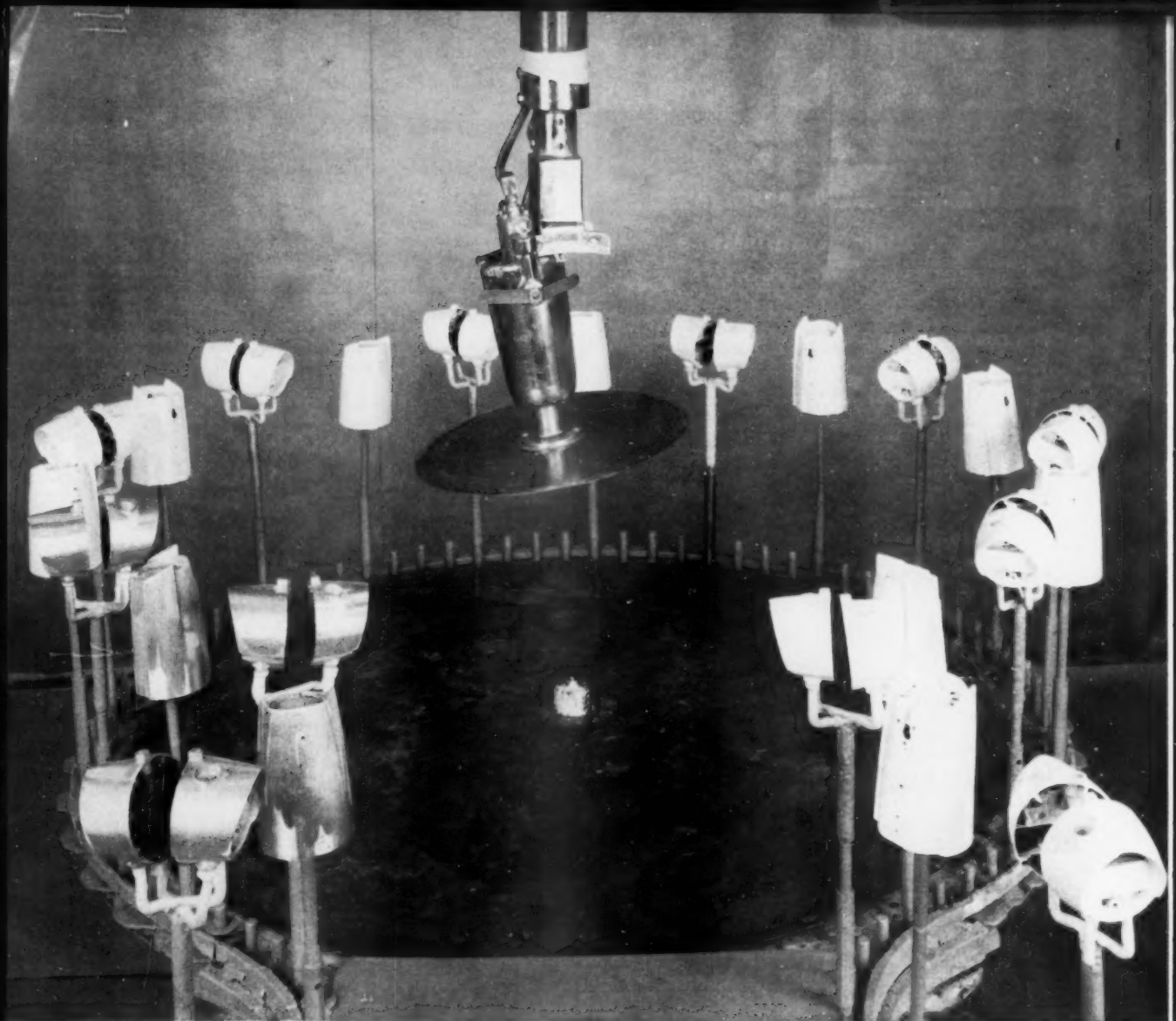
CONSULT US

Send for your FREE copy of our 20-page book which shows the different types of masks and gives case-study illustrations of their use. Or send your samples and drawings for consultation and estimates.



WM. M. FIORE INC.
269 41st Street Brooklyn 32, New York

For more information circle No. 76 on the Reader Servie Card



ELECTROSTATIC PAINT SPRAYING of die cast mixer parts. The use of electrostatic spraying has shown a 60% saving in paint and reduced rejects to less than 1% of total production.
Photos: Courtesy, the Enameled Steel and Sign Co.

Job Shop Painting of Die Castings

By PETER T. SPERA*

A JOB shop painter has to be ready for anything, and when a lot of the work is painting zinc and aluminum die castings, the shop has to be ready for high production. That's why we have replaced a lot of hand operated spray guns with Ransburg No. 1 and No. 2 electrostatic spray units.

In a job shop such as ours, labor is 40% of the sales dollar and material another 20%. Any real saving in either of these items can mean a good big saving. Generally speaking the Ransburg No. 1 unit gives us a 30% saving in paint and the No. 2 unit a 60% paint saving.

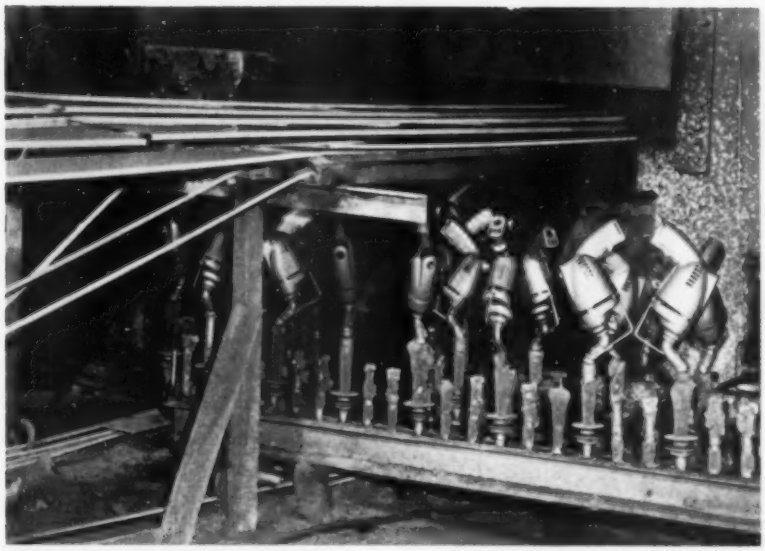
Here are some of the results we have gotten:

CASE 1—A VACUUM CLEANER HOUSING. With hand spray methods we got 220 housings per 5 gallons of paint. With the Ransburg No. 2 unit we now get 500 housings per 5 gallons of paint.

CASE 2—FOUR DIFFERENT ALUMINUM DIE CASTINGS. With electrostatic spraying we turn out 14,000 pieces (3,500 complete units) per eight hour shift. The job is on a spindle conveyor making a loop around a Ransburg No. 2 disc.

CASE 3—THE DORMEYER MIXER UNIT AND THE PORTABLE MIXER, THE "DORMEY". The large mixer has five painted parts; the zinc die cast motor base (two parts), the zinc die

*PLANT SUPERINTENDENT, ENAMELED STEEL & SIGN CO.



FULLY CONVEYORIZED OVENS allow maximum rates of production. This oven actually has three conveyors entering it. The flat bed in the center and two spindle conveyors, one above and one below.

LOW LABOR CHARGES are possible with electrostatic paint spraying. Only loading and unloading need to be done manually. One operator can oversee painting operations in a number of booths.

cast arm support, a steel turntable and the mixer base. On the "Dormey" the die cast aluminum housing is painted in four colors, white, pink, turquoise, and yellow. All of these parts are handled on a spindle line, with one housing per fixture. The fixtures rotate as the parts loop around the electrostatic spray unit.

To do the wide variety of work that is required, we have 12 electrostatic units capable of handling about any type of paint job. Baking is in 5 gas, 9 infra-red ovens.

All work goes through the ovens on conveyors and one of the gas fired units carries three conveyors. A flat bed conveyor goes through the center and spindle conveyors go through in the upper and lower sections, handling most jobs.

This shop normally employs about 100 people and, with the high speed electrostatic painting units and the conveyorized ovens, we can—and do—turn out a volume of painted parts.

LUSTER-ON®

PIONEER IN

CHROMATES

NOW OFFERS DECORATIVE

COLOR

ON ECONOMICAL

ZINC

At long last you can now secure beautifully bright, gleaming colors from a simple LUSTER-ON chromate dip process for your zinc plated small parts.

These are not just spotty identification colors. These are scintillating golds, yellows, blues, greens, violets, reds, brass and copper hues that will add glamor and sales appeal.

Especially Brilliant on Wire Goods

Be the first in your field to offer this sales booster. Write or wire today for the full story on low-cost LUSTER-ON COLOR.

Samples Gladly Processed Free

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THE *Chemical* CORPORATION

66 Waltham Ave., Springfield 9, Mass.

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FREE BROCHURE shows How You Can CONTOUR GRIND Dies for POWDER METALLURGY!

IMPORTANT TO YOU!

Free booklet tells how VISUAL GRIND facilitates construction of precision high-production dies, dies for powder metallurgy, lamination dies and special purpose dies. VISUAL GRIND permits through, blind and templet grinding . . . permits continuous inspection by magnifying work from 10:1 to 100:1 . . . upgrades semi-skilled labor . . . permits easy maintenance of dies in your own plant . . . reduces costly down time. VISUAL GRIND COMPLETES YOUR TOOL ROOM.

Visual Grind solves the problem in mind

Intricate grinding jobs like those shown above ordinarily involve several machines. ALL WERE FORM GROUND ON A SINGLE VISUAL GRIND.

CLIP and MAIL THIS COUPON TODAY

The CLEVELAND GRINDING MACHINE Co.

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Please send me the free brochure describing the capabilities of the VISUAL GRIND.

Name ..... Title .....

Company .....

Address .....

City ..... State .....

For more information circle No. 79 on the Reader Service Card

DATA IN ADS

continued from page 66

64. Fire-Resistant Hydraulic Fluid — Complete technical information on Shell Irus Fluid 902 has been issued by the Shell Oil Co.

65. Extrusions — A new brochure from Precision Extrusions, Inc., presents detailed case studies on cost-cutting examples of aluminum extrusions. Included are actual solutions to design problems.

70. Investment Casting Services — Westinghouse Electric Corp., Materials Manufacturing Dept., will design, engineer and produce parts to customer specifications. Detailed information is offered.

71. Piston Lubricator — Illustrated folder describes the Dorsey automatic piston and cylinder lubricator for aluminum cold chamber die casting machines. Westbrook Mfg. Company.

73. Non-Ferrous Finishing — Detailed laboratory and engineering reports on the finishing of non-ferrous metals by the "Iridite" process are available from Allied Research Products, Inc.

74. Cromate Color Coatings—for zinc-plated small parts are described in literature offered by The Chemical Corporation.

76. Painting Masks — A 20-page book shows the different types of spray masks offered by Wm. M. Fiore, Inc. Includes case-study illustrations of their use in making precise registration possible.

78. Die Casting Machines — A line of low-cost, high-speed equipment is described and all specifications given in a folder offered by American Die Casting Machinery Co.

79. Die Grinding — Brochure describes capabilities of "Visual Grind" system in construction of precision high-production dies, dies for powder metallurgy, lamination dies and special purpose dies. Cleveland Grinding Machine Co.

81. Investment Casting — An illustrated brochure from Hitchiner Mfg. Co. presents information on how you can utilize the freedom and savings offered with Investment Casting.

82. Molds — 4-unit master-molds that allow casting of four different sizes, shapes and products at one time, are described in literature from Richards Tool & Mold Co.

84. Rubberized Abrasives — for micro-deburring, smoothing, cleaning,

polishing on hard or soft metals and other materials, are described in a catalog and application data sheets issued by Cratex Mfg. Co.

85. Extrusion Presses — and processing machines are presented in Sutton Engineering Company's new bulletin No. 50. Illustrated, the booklet presents a selection of typical hydraulic extrusion presses and other machines for processing metals.

HOWARD L. WRIGHT IS MANAGER OF NEW DEPT.

WRIGHT

In a move toward greater diversification, HANSON-VAN WINKLE-MUNNING CO. has appointed Howard L. Wright as manager of the new Special Product Sales. The new sales section will develop new markets for the company's products, especially in the field of electrical and mechanical products.

NEW SALES MANAGER FOR NEILSON CHEMICAL CO.

IZZETT

In a move to strengthen its field organization, NEILSON CHEMICAL CO. has appointed Robert Izzett as midwestern regional sales manager. Mr. Izzett will supervise sales in Iowa, Illinois, Wisconsin, Minnesota and Northern Indiana.

Neilson Chemical Co. manufactures metal treating chemicals for phosphate coating, cleaning and preparing metals for painting.

HOUGHTON CO. ANNOUNCES NEW DIVISION

In a move to expand their services to the iron and steel industry, the E. F. HOUGHTON & CO. have announced additions to their Steel Mill Div. The iron and steel industry is already covered by a field and technical force of over one hundred men. Now two specialists have been added to the division.

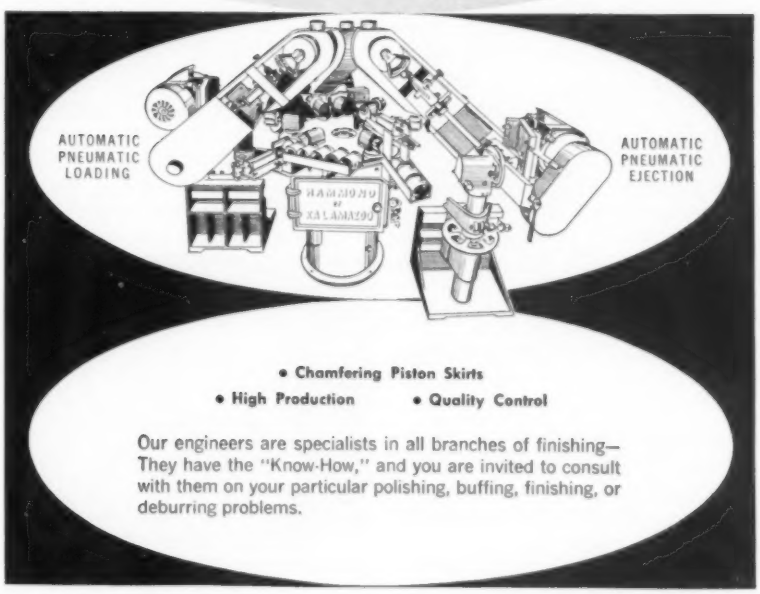
Louis Schlossberg will be manager of the newly formed Strip Mill Sales Div. and William C. Johns, manager of the Bar, Tube and Wire Div. The new divisions will be under David J. Richards, vice president—sales.

SYMPOSIUM SET ON STRESS CORROSION FRACTURE

The AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS (AIME) will hold a two day symposium on the Physical Metallurgy of Stress-Corrosion Fracture on April 2-3, 1959 at the Mellon Institue, Pittsburgh, Pa.

The meeting will be sponsored by the Institute of Metals Div. and the Pittsburgh Section of AIME. Cooperating societies are the Electrochemical Society, The National Association of Corrosion Engineers, and the American Society of Testing Materials.

Hammond of KALAMAZOO AUTOMATION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• High Production
• Quality Control
Our engineers are specialists in all branches of finishing—They have the "Know-How," and you are invited to consult with them on your particular polishing, buffing, finishing, or deburring problems.

Hammond Machinery Builders INC. 1642 DOUGLAS AVE. • KALAMAZOO, MICH.

SEE US NAT'L METAL EXPOSITION—BOOTH 1250—OCT. 27-31—CLEVELAND

For more information circle No. 77 on the Reader Service Card

Plated under vacuum, these articles have a high-sheen surface that lasts as long as conventionally plated pieces.

Why plating

with vacuum

is easier and more profitable

Without buffing or polishing, without corrosive cleaning baths, without highly skilled help, you can now cover articles like those shown above with a shimmering finish that lasts for years.

All it takes is a CEC vacuum coater and some inexpensive lacquers to make metal and plastic articles look silver, gold, copper, or a multitude of other colors and tones.

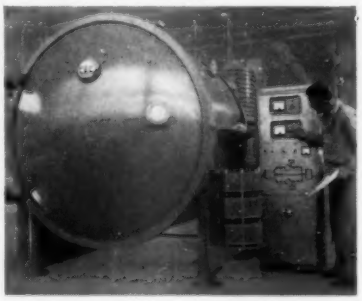
Vacuum-plating costs less. With a CEC vacuum coater you can plate thousands of pieces per day with unskilled labor.

New longer-lasting lacquers. There are on the market many lacquers which can make vacuum-plated articles wear as well as those plated in conventional ways.

The stayfast finish requires no retouching, or buffing, or polishing—just an easily applied coat of lacquer.

You can control film thickness easily and precisely. You can make surfaces electrically conductive *or* insulating as you wish.

For further information on this highly profitable process, write for information on the coaters, the lacquers, and the methods used.



LCI-72—This new 72″ Coater easily accommodates pieces 22″ by 50″ on each of six stations; 5 to 6 cycles per hour.

Consolidated Electrodynamics

Rochester Division, Rochester 3, N. Y.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

For more information circle No. 24 on the Reader Service Card

HYDRAULIC FLUIDS

continued from page 61

was opened for flushing prior to the changeover. The vanes and rings which had been in continuous contact with the fluid were completely free of corrosion and showed no signs of excessive wear.

This supports the use of water-glycol types of hydraulic fluids in applications where lubricity and corrosion resistance are critical factors.

The cost of the water-glycol installation was approximately four times that of oil. Responsible plant personnel believe that this appreciably higher initial cost has been more than offset by the long-run advantages of uninterrupted production. There have been far lower maintenance costs, no need to change fluid, and of course, protection of the entire plant and personnel against possible hydraulic fires.

LINDBERG INDUSTRIAL ACQUIRES CONTINENTAL INDUSTRIAL ENGINEERS

Lawrence H. Remiker, president of LINDBERG INDUSTRIAL CORP. has announced the acquisition of Continental Industrial Engineers of Chicago.

REMIKER

Continental, for the past thirty-five years designers and builders of industrial plants, furnaces and production lines, will become the Continental Div. of Lindberg Industrial Corp. William Darrah, formerly president of Continental, will be vice president of the new Continental Div.

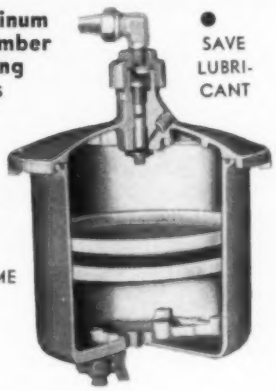
Circle No. 71 on the Reader Service Card

INCREASE YOUR PRODUCTION—
Reduce your costs with

DORSEY PISTON AND CYLINDER LUBRICATOR

for aluminum cold chamber die casting machines

- SAVE LUBRICANT
- PRECISE LUBE CONTROL
- REDUCE DOWN TIME
- FEWER REJECTS
- INCREASE PLUNGER AND CHAMBER LIFE



- **Write now for literature, full details and prices . . .**

WESTBROOK MFG. CO.
P.O. Box 231 — St. Joseph 2, Michigan

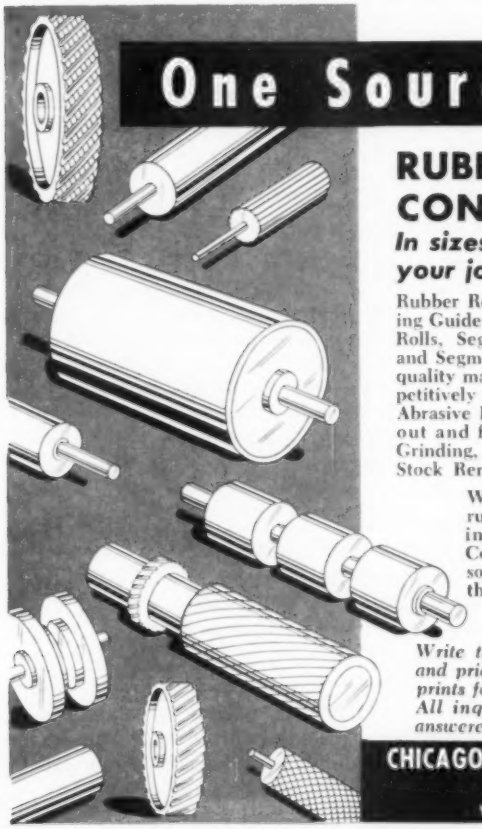
FRUEHAUF TO HEAD DOW'S MAGNESIUM PRODUCTS DEPT.

FRUEHAUF

Coincident with the formation of a new Magnesium Products Department, THE DOW CHEMICAL CO. announced the appointment of Hubert Fruehauf as the department manager.

Mr. Fruehauf will be responsible for magnesium fabricating and semi-fabricating operations at the company's Bay City Div., Bay City, Mich., and the Madison Div., Madison, Ill.

One Source For



RUBBER ROLLS and CONTACT WHEELS
In sizes and coverings to do your job better at Less Cost

Rubber Rollers for all industries, including Guide Rolls, Pinch Rolls, Hold Down Rolls, Segmented Rolls, Coating Rolls, and Segmented Polishing Rolls—Highest quality materials and workmanship, competitively priced.
Abrasive Belt Contact Wheels for Oiling out and finishing aggressive Contour Grinding, Stock Removal, Aggressive Stock Removal, Polishing and Buffing.

World's largest manufacturer of rubber contact wheels, and originators of the famous Cosmo Contact Wheels, specializing in solid urethanes and foam urethanes.

Write today for Catalog and prices, or send blueprints for us to quote on. All inquiries promptly answered.

CHICAGO RUBBER COMPANY, INC.
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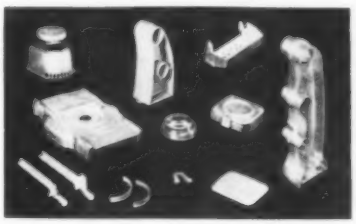
For more information circle No. 75 on the Reader Service Card

YOU CAN CAST SAVINGS INTO YOUR PRODUCTS

There is more to a casting than a mold and molten metal. Design analysis by qualified Monarch foundry engineers, in cooperation with your engineering staff, frequently provides valuable ideas for product improvement and production savings.



Monarch's broad manufacturing operations provide the experience upon which savings can be made in subsequent manufacturing and finishing operations. These advantages are not always possible on straight competitive bidding.

Use 45 years of pioneering casting experience in

ALUMINUM PERMANENT MOLD
ALUMINUM DIECASTING and
CERTIFIED ZINC DIECASTING

Send your next inquiry to Monarch.

MANUFACTURING in MOLTEN ACHIEVEMENTS ALUMINUM

MONARCH ALUMINUM MFG. COMPANY
9205 Detroit Avenue Cleveland 2, Ohio

Circle No. 55 on the Reader Service Card

USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 66-67

PROCESSES

Cast Stainless Steel Data: 137

COOPER ALLOY CORPORATION — A handy reference guide entitled "Technical Data on Cast Stainless Steel" is available which lists 29 heat and corrosion resistant alloys used by the company for custom castings. Designed to aid the specifier and buyer of alloy castings, it contains a cross reference chart of ACI, AISI, SAE and ASTM designations.

Investment Alloys Properties: 138

HAYNES STELLITE CO., DIV. OF UNION CARBIDE CORP. — A new 40-page booklet describes the investment-cast properties of eight stainless and four low alloy steels. Lists chemical compositions, applicable AMS specifications, and mechanical properties. Properties of heat-treated material are given for the hardenable grades of stainless steel and for the low alloy steels.

Investment Castings: 139

JELRUS PRECISION CASTING CORP. — A new Brochure shows the company's facilities for performing each operation in the investment casting process.

Beryllium Copper Castings: 140

NATIONAL PRECISION CASTING — Unique properties of precision castings of beryllium copper include high strength, electrical conductivity, corrosion and wear resistance, and hardness. New brochure gives details.

MATERIALS & EQUIPMENT

Straighteners: 85

SUTTON ENGINEERING CO. — An illustrated brochure describes the company's straighteners for tubes & pipe, round bars and flats & shapes.

Extrusion Presses: 142

SCHLOEMANN AKTIENGESELLSCHAFT — Technical data sheet is available on the company's steel tube and rod press. Controls, features and advantages are included.

Die Lubricant: 143

ACHESON COLLOIDS CO. — Vol. 3 No. 1 of the Dag Disperser discusses "Aquadag", a dispersion of colloidal graphite in water for lubricating extrusion dies.

Extrusion Dies: 144

PMD EXTRUSION DIE CO., INC. — Illustrated brochure discusses the company's facilities for producing all types of extrusion dies and tools.

Melting Equipment: 145

C. H. MILLES FOUNDRY CO. — The Milles fully adjustable and fully portable pump for lead, zinc and zinc die cast is described in a technical data sheet.

Hollow Aluminum Bar Stock: 146

HARVEY ALUMINUM — Technical brochure contains information on hollow aluminum machining stock. Furnished are complete tables of the standard sizes available in round and hexagonal stock, giving the wall thicknesses, dimensions, and weight per foot.

Mechanical Force Gauges: 147

W. C. DILLON & CO., INC.—A line of gauges in twelve capacities from 0-10 to 0-50,000 pounds are presented in an illustrated six-page folder. The equipment can be used alone or incorporated into special testing devices for the precise measurement of pressure, tensile or torque.

Electric Heating Units: 148

HEVI-DUTY ELECTRIC COMPANY—Flat and semi-cylindrical heating units are available in many sizes and in two temperature ranges — 1800°F. and 2200°F. maximum. Bulletin 158 shows diagrams, dimensions, wattages, and prices of the complete line.

Sponge Iron Melting Stock: 149

HOEGANAES SPONGE IRON CORP.—Ancor Sponge Iron, a virgin, soft iron of extreme purity, free from tramp elements and dissolved gases, is now being offered in 3 pound briquettes as a raw material for quality steel production. Literature giving basic facts, typical analysis, and working data is available.

Solid Film Lubricant: 150

HOHMAN PLATING & MFG. CO.—Surf-Kote M-1284, a matrix-bonded solid film lubricant containing molybdenum disulfide, utilizes a new metallic bonding principle that permits varied uses. The compound forms a solid dry film which resists extreme pressures and temperatures.

Electric Conveyor Furnace: 151

C. I. HAYES, INC.—Bulletin 5710 describes "Humpback" (Elevated Heating Chamber) electrically heated conveyor furnace, for bright heat treatment, copper brazing and nicro-brazing of stainless steels, ceramic to metal brazing, and bright hardening of high carbon high chrome, air hardening type steels. Patented features of the equipment are said to allow three to five times the production loads of comparable furnaces.

Powder Metal Press: 152

F. J. STOKES CORPORATION—Model 640 50-ton multiple-motion powder metal press simplifies tooling, gives centralized set-up and control and requires little maintenance. Complete data available.

Furnace Catalog: 153

LINDBERG ENGINEERING COMPANY—Bulletin No. 250 illustrates and explains tempering furnaces, controlled atmosphere hardening furnaces, brazing and sintering furnaces, and melting furnaces. Some laboratory equipment is included.

continued on page 80

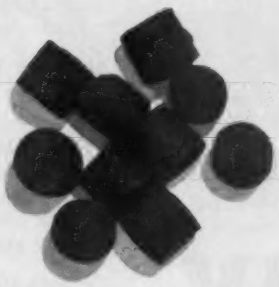
NEW

PRECISION-CONTROLLED TUMBLING MEDIA

for faster... more uniform barrel finishing at low cost

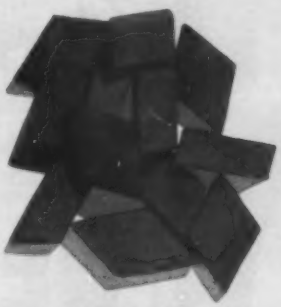
ALUMINUM OXIDE NUGGETS

Provide a fast cutting action for grinding, deburring, and polishing and require no breaking-in period. Their long-wearing qualities help minimize the problem of lodging in parts.



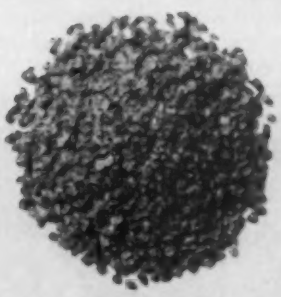
ALUMINUM OXIDE VITRIFIED PELLETS

Controlled bonded shapes formulated to give maximum "cut" with minimum wear. They are particularly advantageous where lodging must be prevented and where a rapid rate of cut is desired.



"CARBO-RUBS" RUBBER BONDED MEDIA

Parallelogram-shaped rubber bonded media. They are used primarily where the burr is light and action must be gentle. Used to produce a high "color" and to remove burrs from non-ferrous parts.



ALUMINUM OXIDE GRAIN

Designed for the economical finishing of small metal parts. Also used as an additive to augment the cut of various other tumbling media. Coarser sizes are used in the new "spinner-type" finishing equipment.

"CARBO-BRITE"

An electric furnace product having a fine crystalline structure and slow wearing qualities which adapt it to burnishing operations where high color is desired.

Manufacturers of metal parts which require deburring, scale removal, polishing, honing, blending, or burnishing operations can now produce finer finishes *at lower costs* by using the new *precision-controlled* Tumbling Media by CARBORUNDUM. New improvements in the manufacture of abrasive media at CARBORUNDUM assure exceptionally high output per barrel with absolute uniformity of parts and finishes. Even unusual shapes and sizes can be mass-finished to precision tolerances...at a fraction of the time and cost. CARBORUNDUM's wealth of abrasives know-how is available to assist you in working out your own parts finishing problems.

Write for this

FREE

Booklet

A practical guide describing barrel finishing of metallic parts on a mass production basis with Tumbling Media by CARBORUNDUM.

THE CARBORUNDUM COMPANY
Dept. PM 83-817, Niagara Falls, New York

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TAPERED WALLS minimize distortion

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REFAX® POTS

TAPERING wall thickness and scientifically-designed side-wall angles minimize swelling and distortion, assure far longer useful life for acf Refax Pots. Alloy cast iron absorbs heat rapidly and holds it with minimum re-heating. Fast delivery in all styles and sizes. For complete information on the full line of Refax Pots, Ingot Molds, Utility Castings and Goosenecks, write Dept. PM-5.

AMERICAN CAR AND FOUNDRY
DIVISION OF acf INDUSTRIES, INCORPORATED
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USEFUL LITERATURE

continued from page 78

Fast Ball Mills: 154

STEELE & COWLISHAW LTD.—Greatly accelerated grinding action is claimed for English-built mills that operate on a planetary motion principle. A powerful centrifugal force is set up which holds the grinding media and charge against the wall of each pot. Literature offered by Kady International Corp., U. S. distributor, tells the full story.

Ammonia Dissociators: 155

DREVER COMPANY—Equipment produces an ideal furnace atmosphere that eliminates surface oxides and inter-granular oxidation in heat treatment of metals. Extreme dryness of the gases eliminates need for dehydration prior to use. Comprehensive data on properties of the gases, features of equipment and costs is given in Bulletin B-53.

Vacuum Heat Treating: 156

C. I. HAYES, INC.—New features of the Vacu-Master (VAC-18) vacuum heat treating furnace include faster heating and cooling cycles, easier work handling, and better process control. Bulletin 5704 explains them in detail, and lists typical applications.

Die Steels: 157

LATROBE STEEL COMPANY—Technical data sheet explains properties and uses of a line of hot work die steels, give hardening and tempering curves and annealing instructions, and typical analysis. Lists of available stock sizes are included.

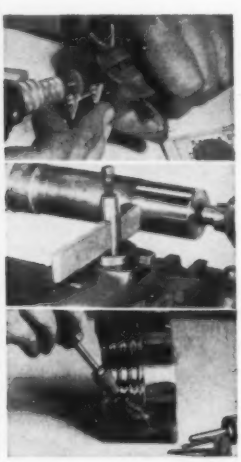
CUT COSTS SAVE TIME IMPROVE QUALITY

use **CRATEX**
Rubberized Abrasives

for MICRO-DEBURRING, SMOOTHING, CLEANING, POLISHING on HARD or SOFT METALS and other materials

4 grit textures
Course—C • Medium—M
Fine—F • Extra Fine—XF

WHEELS • POINTS • BLOCKS STICKS • CONES for power or manual application and dimensional control. CRATEX is sold through leading industrial supply distributors.



For actual field application reports on how CRATEX "cushioned action" can cut costs in your own operations, send this coupon.

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☐ Stainless Steel
☐ Aluminum
☐ Brass & Bronze
☐ Cast Iron
☐ Heat-treated Steel
☐ Special Alloys

For more information circle No. 84 on the Reader Service Card

Carbide-Tipped Saw Blade: 158

RADIAL CUTTER MANUFACTURING CORPORATION — A new circular saw blade was specially-designed for cutting non-ferrous metals, reduces formation of burrs. Complete price, size and specification data is furnished in a catalog sheet.

Die-Casting Alloys: 159

AMERICAN SMELTING AND REFINING COMPANY— Properties and applications of "Di-Metal" alloys are described in a 32-page booklet. One section lists die-casting alloy specifications of the ASTM, SAE, U.S. Army, U.S. Navy and Aeronautical Material Specifications. Another section gives extensive data on casting and die design.

Refractory Castables: 160

MEXICO REFRACTORIES CO., — A comprehensive 24-page booklet discusses a complete line of refractory castables, gives a step by step explanation of how to use them.

Low-Cost Induction Melting: 161

AJAX ELECTROTHERMIC CORP. — New Multiductor furnace power supply is a frequency converting transformer; has no moving parts, is easy to operate. Bulletin explains the systems many advantages.

Aluminum Melting Furnace: 162

ECLIPSE FUEL ENGINEERING CO. — Bulletin C-80 presents exclusive features of furnaces designed to prevent formation of oxide on hearth, gassing and overheating of metal. Melting capacities range up to 2000 lbs. per hour.

continued on next page

USE OUR YEARS OF EXPERIENCE DESIGNING & BUILDING DIE CASTING DIES

- Large staff of design engineers and skilled die makers.
- 3-dimensional duplicators to 30" x 60".
- Hydrotels and pantographs, Rotary head mills. DeVleig jig mill.

For complete facilities list and further information write to:

Alliance Mold Company, Inc.

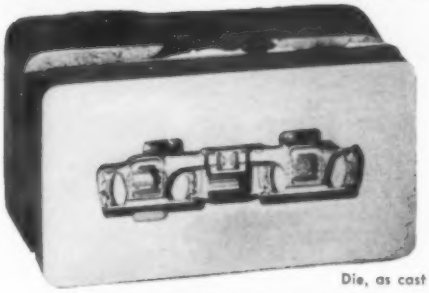
FORMERLY ALLIANCE SPECIAL PRODUCTS DIVISION, INC.

1300 MT. READ BLVD., ROCHESTER 6, N. Y.

For more information circle No. 11 on the Reader Service Card

For more information circle No. 72 on the Reader Service Card

STEEL DIES & MOLDS



Die, as cast

by the SHAW PROCESS

ZENITH PRECISION CASTING IS NOW PRODUCING TOOL STEEL PLASTIC MOLDS, DIE CASTING DIES AND CAVITIES BY THE SHAW PROCESS.

Zenith Shaw cast molds and dies feature:

- Longer die life than cut dies.
- Complex parting lines easily produced.
- Less deformations in heat treatment.
- Only polishing necessary . . . often dies can be used as cast.
- Shortest delivery time.
- Extremely economical.
- Immediate availability of replacement parts.

Zenith has been producing precision cast parts for more than twenty years.

We welcome your inquiry.

Zenith Precision Casting Company, Inc.

130 West 46th Street • New York 36, N.Y. • Judson: 2-2234

Lepel

HIGH FREQUENCY *Induction* **HEATING**

HARDENING
SOLDERING
ANNEALING
MELTING
BRAZING

LEPEL Electronic Tube GENERATORS — 1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

LEPEL Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

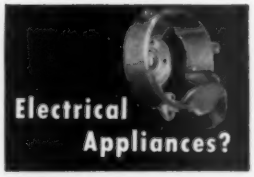
All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

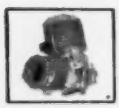
LEPEL HIGH FREQUENCY LABORATORIES, INC.

55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

For more information circle No. 49 on the Reader Service Card

What are your zinc or aluminum die casting needs...



ADVANCE know-how in Zinc and Aluminum die casting design, engineering and production covers a wide range of component part needs from small camera parts. . .  . . . to engine cylinders

Moreover, ADVANCE often solves a product sales problem by alert die casting engineering and skills which smooth-up product lines and appearance while at the same time improving casting cycles and lowering part costs.

That is why ADVANCE Zinc and Aluminum die cast parts are important components everywhere in home appliances, office equipment, power tools, gas engines, cameras, surveyors' instruments, electric motors and control devices.

Consult ADVANCE about your die cast parts problems . . . and write for folder "YOUR DOORWAY to Certified Zinc and Precision Aluminum Die Castings."

These symbols are your assurance of highest quality control of zinc and aluminum alloys under ADCI standards.
38 years of service to industry.

ADVANCE TOOL AND DIE CASTING CO.

3782 N. Holton Street
Milwaukee 12, Wisconsin

For more information circle No. 3 on the Reader Service Card

USEFUL LITERATURE

continued from page 81

Pyrometer Supplies: 163

RAYMOND F. MCHUGH & SON—A new 16-page catalog illustrates and describes a full line of precision-matched Pyrometers and Thermocouples which can be used interchangeably with any make of pyrometer or thermocouple thermometer. The units are for all industrial purposes requiring high heat measurement. An engineering service for the design of special thermocouples and pyrometers to meet special heat-measuring problems is also described.

Pyrometer: 164

ILLINOIS TESTING LABORATORIES, INC. — A new 6-page brochure describes the Alnor Pyrotroller (R), an indicating-controlling pyrometer which features simplicity, small size, long service life. Complete indicator and controller specifications are included, with typical wiring diagrams showing application of the Pyrotroller on electrically heated, gas- or oil-fired equipment.

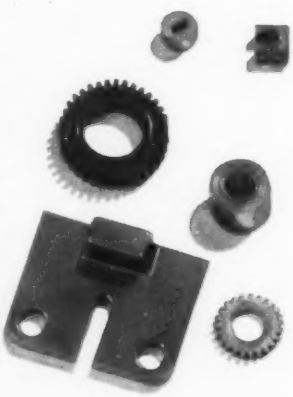
Test Furnaces: 165

MARSHALL PRODUCTS CO. — Technical details are offered on high temperature electric furnaces for performing tensile, creep, and stress rupture tests on steels and alloys with accuracy and ease. Features of the equipment include up to ±1° F. uniformity in temperature distribution, close-limit temperature control, and zone-by-zone heat adjustment.

HIGH-DENSITY POWDER METAL PARTS

Carburized tensile strength to 200,000 psi.

Supermet combines the economy of powder metallurgy with the properties of controlled carburization to give you solid steel parts at low cost. Seven ranges of properties available in electrolytic iron; we also invite stainless steel parts. As an indication of accuracy, we are currently pressing AGMA commercial class 4 spur gears. Send a part print for evaluation.



GLOBE

SUPERMET DIVISION
GLOBE INDUSTRIES, INC.
1465 Cincinnati St.
Dayton 8, Ohio

For more information circle No. 31 on the Reader Service Card

FINISHING

Chemical Conversion Coatings: 192
AMERICAN CHEMICAL PAINT COMPANY — Bulletin 1424-A presents a number of protective and prepaint coating chemicals for aluminum. Advantages of the coatings, methods of application, and equipment used in the processes are covered.

Buffing Materials: 193
HANSON-VAN WINKLE MUNNING CO. — A new 12-page bulletin describing a complete line of cutting and coloring buffs stresses importance of selecting a "job-tailored" buff. Separate sections describe and illustrate a comprehensive range of buff types with the manufacturer's suggested applications for each type.

Parts Inspection Equipment: 194
MAGNAFLUX CORPORATION — 12-page booklet presents 9 systems of non-destructive testing: systems give visual indication of surface and sub-surface flaws in a variety of materials. One, called "Stresscoat", shows stress concentrations.

Hand Milling Tools: 195
PRECISE PRODUCTS CORP. — 27-page catalog and supplemental price sheet give complete data on powerful hand grinder-millers, along with milling machines, lathes and drill presses powered by the units. Models develop up to 1½ HP at 25,000 RPM.

Phosphate Coating for Steel: 199
AMERICAN CHEMICAL PAINT CO. — A 4-page color brochure describes various phosphate coatings for bonding paint and protecting the metal from underfilm corrosion. The coatings can be applied by dipping, spraying, or brushing.

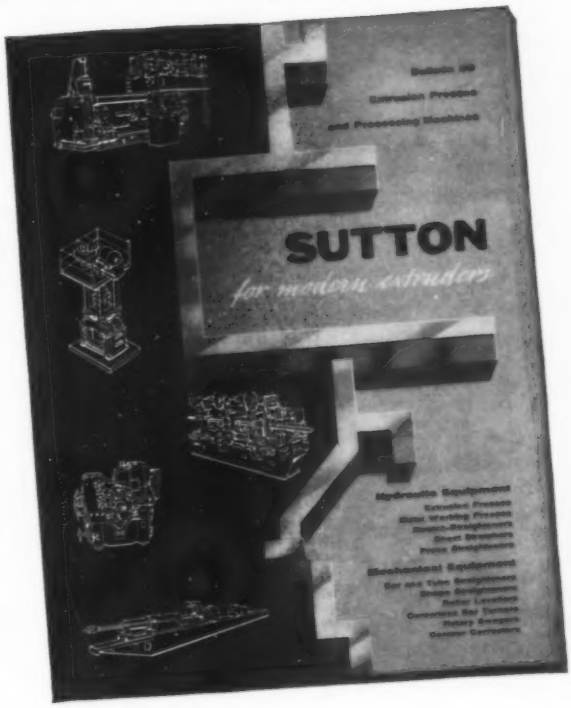
Aluminum Paint Data: 200
JOSEPH DIXON CRUCIBLE COMPANY — A four-page brochure tells why aluminum and aluminum graphite paints give high protective service on steel, galvanized iron, tin plate and other hard-used surfaces. Gives relative merits of different types of aluminum paints, along with test data comparing properties of ordinary paint film and aluminum paint.

Air Tools: 201
PRATT & WHITNEY CO., INC. — Circular No. 616 describes "Kellerflex" high speed air tools which operate at free speeds of up to 60,000 rpm. Designed for powering steel burs, sanding drums, and polishing accessories, the units operate from a standard air supply.

Fastener Catalogs: 202
ELASTIC STOP NUT CORPORATION OF AMERICA — Three catalogs include complete product information on self-locking bushings, spring pin fasteners, and elastic stop nuts approved for aircraft use.

Dye Penetrant Inspection: 204
MAGNAFLUX CORP. — Complete illustrated literature is offered which explains new nonflammable Spotcheck dye penetrant inspection materials. Available in either pressure-spray cans or in bulk, Spotcheck provides a fast means of volume inspecting castings for cracks, porosity and other defects.

Here's News
FOR MODERN EXTRUDERS



A Presentation of
SUTTON EXTRUSION PRESSES
and PROCESSING MACHINES

New Sutton Bulletin 50 presents in one handy illustrated booklet, a selection of typical Sutton hydraulic extrusion presses and other important machines for processing modern metals.

Write for your copy or ask at
SUTTON BOOTH No. 2751
National Metal Exposition

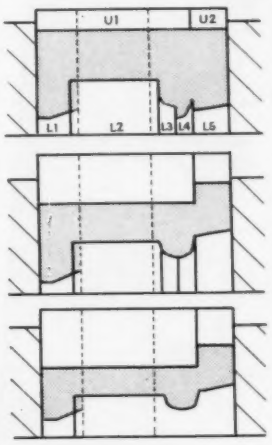
SUTTON
Engineering COMPANY
First National Bank Bldg., Pittsburgh 22, Pa.
Phone: GRant 1-8077 • Plant: Bellefonte, Pa.

For more information circle No. 85 on the Reader Service Card

PRESSES FOR

PRODUCTION BRIQUETTING AND COINING OF POWDERED MATERIALS INTO COMPLEX SHAPES BY WITHDRAWAL TYPE TOOLING

RIFLE SEAR



1. Initial pressing position. Independent punch adjustment for correct fill height.
a. Two upper punches
b. Five lower punches
c. One core rod

2. Intermediate pressing position. Independent movement of lower punches results in proper flow of powder and uniform density throughout.

3. Final pressing position. Double pressed and sintered properties:
Tensile — 57,000 psi
Yield — 46,000 psi
Elongation — 15%
Density — 7.3 g/cc

Is tooling limiting your ability to produce a part like the above to close tolerances and uniform density? A. Johnson, suppliers of HVA Electrolytic Iron Powder, now offer outstanding European Compacting Presses featuring rugged but simple design, extra large size die cavity, ease of set-up, and economy of purchase and operation. Press capacities are available in sizes between 6.5 and 1100 tons.

	Soenen Model No. 200T-50	Spiertz Model No. K2C100sp
Capacity	220 tons	1100 tons
Motor horsepower	25	25
Strokes per minute	7-20	5-18
Upper ram stroke	7-7/8"	11.81"
Upper ram adjustment	3-5/16"	0.59"
Lower ram stroke	6"	7.67"
Lower ram adjustment	4"	4"
Die fill height'	6"	7-5/8"
Max. length of longest punch	7-1/2"	9-1/8"

We invite your inquiries concerning scheduled demonstrations of this equipment.

MEMBER METAL POWDER mpi INDUSTRIES FEDERATION

A. JOHNSON & COMPANY, INC.

21 WEST STREET • NEW YORK 6, N.Y.

For more information circle No. 44 on the Reader Service Card

FOR YOUR PARTICULAR NEEDS

Let us show you with these factual case histories how designing for

BRASS and NICKEL SILVER POWDER METALLURGY

can save you money

Write today for your copy of
"The use of BRASS and other nonferrous powder parts"

THE NEW JERSEY ZINC COMPANY
160 Front Street, New York 38, N. Y.

For more information circle No. 59 on the Reader Service Card

NEW ASARCO BOARD CHAIRMAN ANNOUNCED

MAC KENZIE

John D. MacKenzie has been elected chairman of the board of AMERICAN SMELTING & REFINING CO. His election fills a vacancy left by the death of Kenneth C. Brownell. MacKenzie will continue as president of the company.

GEN'L. SMELTING APPOINTS NEW OFFICERS

POMEROY

GENERAL SMELTING CO., one of the older smelters of secondary zinc and aluminum, has announced two changes in its top officers.

J. Nevin Pomeroy, formerly president, is now Chairman of the Board and senior consultant. John N. Pomeroy, Jr., formerly assistant to the president, has been elected President.

At the same time, the company announced that plans are in an advanced stage for an extensive expansion and product diversification program.

FEDERATED METALS TO SELL PRIMARY ALUMINUM

REVERE COPPER AND BRASS, INC. has appointed the Federated Metals Div. of American Smelting & Refining Co. as national distributor of Revere primary aluminum pig and ingot. Distribution will be to the foundry and die casting industries.

Revere aluminum is produced at the Ormet Corp. a jointly owned facility of Revere and Olin Mathieson Chemical Corp. The Ormet reduction plant is near Omal, Ohio. It will have an annual capacity of 180,000 tons of primary aluminum, being the fourth largest producer.

JACK BEAN TO HEAD BAY CITY FOUNDRY CO.

THE BAY CITY FOUNDRY CO. has been acquired by Jack Bean, Harold Schroeder, and Philip G. Smith. All three men are Detroit area industrialists. The new facility will be headed by Mr. Bean as president. Present plans are to continue operations of the foundry with the present personnel.

LOCAL BOYS MAKE GOOD WITH LOCAL ZAMAK* USERS

because they give **personal** service

*also aluminum, bronze, lead, brass, zinc

At HB&S you can

- **pick up the phone and get the answer to your questions on the spot**
- **call an order in for same day shipment, in an emergency**
- **receive palletized delivery to any point within your plant and the many other big little things that help you produce a better product at lower costs.**

At HB&S you get big-order, big company attention. Service is individualized to fit **your** needs . . . alloys specifically **engineered** to meet **your** requirements.

See what a difference HB&S service . . . HB&S quality make:

Spectrographic analysis of all production

Alloy number on every ingot

Heat number on every pallet

Start-to-finish quality control for alloys

100% on spec.

And yours for the asking Henning's Pocket Guide to Better Casting

Write TODAY for your copy of "Die Casting with Zinc Alloy" explaining the factors influencing the production of sound castings and the causes of faults and defects.

HENNING BROS. & SMITH, INC.

91-117 Scott Ave., at Randolph St., Brooklyn, N. Y.
Smelters and refiners of aluminum, bronze, brass, zinc, lead
Dependable service since 1922

For more information circle No. 36 on the Reader Service Card

NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 66 of this issue

NEW SINTERED TUMBLING MEDIA . . . costs less, has greater life

Unique advantages for deburring, cutting and burnishing. These are the features of new tumbling media, produced by a sintered process, and developed by DIXON SINTALOY, INC.

With these sintered shapes it is possible to have precise control of material hardness, shape, porosity and surface characteristics.

In addition to uniformity, the new shapes can be impregnated with auxiliary cutting, polishing, or finishing compounds and can also be heat-treated. They will not powder or break down in use, nor will they clog or lose their cutting characteristics with repeated use. The media can be used dry.

Circle No. 205 on Reader Service Card

NEW ROTARY CONVEYOR
. . . for use with polishing head units

A Model "RJ" Rotary Conveyor of the indexing type, for use with polishing, buffing and brushing head units on automatic installations, has been introduced by the DEVINE BROS. CO.

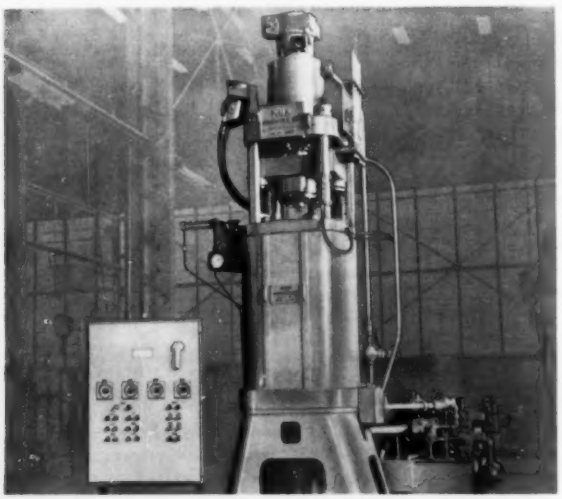
The rotary dial conveyor consists of a heavy welded steel base, cylindrical in the main section. Into this is mounted the dial and work spindle driving mechanism. A louvre door provides easy access to the dial drive motor, fixture drive motor and mechanism within.

The mechanism consists of a gear reduction and variable speed drive for the dial plate.

The work holding dial is provided with six ball bearing mounted fixture spindles of 1½" diameter x 3". The dial index rate is adjustable from 120 to 1800 indexes per hour with fixture spindle speed adjustable from 12 to 100 rpm.

The fixture spindles are equally spaced on a 45" diameter circle.

Circle No. 206 on Reader Service Card



NEW POWDER PRESS CAN COMPACT
. . . two different materials in the same operation

KUX MACHINE CO. has introduced a fully automatic and hydraulic powder compacting press, capable of compressing two entirely different materials in the same operation.

Two independent, shuttle-type feed shoes and hoppers make possible bi-material compacting at production speeds up to 15 per minute. These new presses, available in 50, 100, 200, 300 and 500 ton sizes, will in one operation compact both layers of material into one unit, accurate as to weight and dimensional tolerances. Included are all needed adjustments for die fill pressure, ejection and timing sequence controlled electrically and hydraulicly from a control panel.

Circle No. 207 on Reader Service Card

continued on page 89

You get speedier service from the

ZINC ZONE

Central location of American Zinc plants assures prompt deliveries of slab zinc to any point in the nation.

HILLSBORO, ILL., PLANT
Prime Western, Brass Special, Intermediate, High Grade, Continuous Galvanizing Grades
MONSANTO, ILL., ELECTROLYTIC PLANT
Special High Grade, High Grade, Continuous Galvanizing Grades, Special Shapes
FORT SMITH, ARK., SMELTER
Prime Western, Brass Special
DUMAS, TEXAS, SMELTER
Prime Western, Brass Special, Continuous Galvanizing Grades

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

American Zinc Sales Company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

For more information circle No. 7 on the Reader Service Card

PLAST-IRON POWDERS

Grade B-280

Reduced Iron Powder-80

One Pressing at 30 TSI

One Sinter at 2050°F-30M

27,500 PSI Tensil

68,500 PSI Modulus

Rockwell 85H

Add 7% Copper

40,500 PSI Tensil

77,500 PSI Modulus

Rockwell 50B

Send for Technical Data and Working Sample

PM PLASTIC METALS

PLASTIC METALS

Division

National-U.S. Radiator Corporation

3458 BRIDGE STREET

JOHNSTOWN, PA.

Circle No. 57 on the Reader Service Card

For more information circle No. 45 on the Reader Service Card

the best castings are usually made with

Kerr Investments

The outstanding performance of Kerr's complete line of Investment Materials and associated chemical products has made them the *Number One Choice* in leading casting plants from coast to coast in the U. S. and in many foreign countries.

For the finest in Ferrous and Non-Ferrous Investments, look to Kerr—most people do.

Write for complete catalog of investment materials and other related industrial products.

KERR industrial investments

KERR MANUFACTURING COMPANY

ESTABLISHED 1891 • DETROIT 8, MICHIGAN

6 GOOD REASONS *Why You Should Specify* MERRIMAN POWDERED METAL PARTS

1. HIGHEST QUALITY — ALL WAYS
2. GUARANTEED TO FIT
3. DIMENSIONALLY ACCURATE
4. PROVEN PERFORMANCE
5. LOW COST
6. FASTEST DELIVERY

Originators of Sintered Helical Gears High Density, precision structural parts from powdered metal in

Brass, Bronze, Copper, Nickel Silver Steel, Iron and Iron Alloys. Copper Infiltration

POWDERED METAL DIVISION

MERRIMAN BROS., INC.

185 Amory Street Boston 30, Mass.

REPRESENTATIVES IN PRINCIPAL CITIES

4324 W. Florissant Ave. St. Louis, Missouri

33 University Ave. Rochester, New York

P. O. Box 181 West Concord, Mass.

For more information circle No. 53 on the Reader Service Card

NEW PRODUCTS

continued from page 89

PHOSPHATING ANALYSIS KIT

. . . determines adaptability of parts to phosphating

A phosphating analysis kit that enables metalworking manufacturers to determine whether their products are adaptable to phosphating and to the many paint adhesion advantages it offers, has been developed by TURCO PRODUCTS, INC. The kit is available to any manufacturer in the metalworking field.

Circle No. 216 on Reader Service Card

NEW BAR LUBRICANT

. . . is all purpose

Lea AP LUBAR is a all purpose bar lubricant for use on polishing wheel and abrasive butts. It applies to the belt easily and uniformly leaving an excellent wet surface. Manufactured by the LEA MFG. CO., the lubricant eliminates loading or packing of abraded particles of metal on the cutting face of belts and polishing wheels.

Circle No. 222 on Reader Service Card

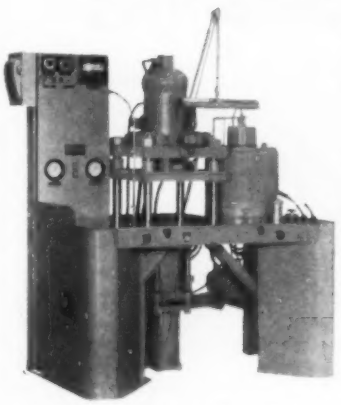
continued on page 90

For more information circle No. 48 on the Reader Service Card

LEYDEN WAX INJECTORS

Another New Model!

Vertical Hydraulic Press With Bottom Injection



Model No. FBIWP

Over 200 machines in the field have proved their superiority. Write for complete specifications and features of the Leyden Models vertical platen—side or center injection—horizontal platen—center injection.

LEYDEN wax injection machines are the last word in the field of wax injection. They are the result of years of research and experience.

SOME EXCLUSIVE FEATURES

- Completely hydraulic—operated by self-contained power unit.
- Two hydraulic pumps—one for clamping and one for injection.
- Clamp and injection pressure independently adjustable.
- Entire wax unit heated by circulating oil.
- Thermostatically controlled, electrically heated nozzle—optional.
- Temperature controlled to plus or minus ½° F.
- Agitator spans full diameter of the pot, keeping wax mixed uniformly.
- Universal movement of nozzle to facilitate misaligned dies.

LEYDEN HYDRAULICS, INC.

1800 North River Road • Melrose Park, Illinois

FOR DIE-CASTERS

• LUBRICATES
• CLEANS

BUILT TO LAST

P-W AIR-LUBE SYSTEM

Patent Applied For

- VAPOR IS ADJUSTABLE
- INCOMING AIR IN TANK AGITATES LUBRICANT

Speeds production and eliminates many causes of down-time through effective cleaning and *adjustable* thin-film lubrication of all mold-cavity surfaces.

PROVED IN USE BY PROMINENT DIE-CASTERS

S-W-I-S-HI One pressure whisks mold clean with powerful air jet. S-W-I-S-HI Further pressure on same lever shuts off air and lubricates.

PIERCE-WALLER CO.

KETTERING P.O. BOX 2121A, DAYTON 9, OHIO

Circle No. 61 on the Reader Service Card

HELP from GRC for SMALL PARTS users

The story is in these two bulletins:

Small zinc alloy die castings exclusively

Injection molded tiny NYLON (other plastic) parts

GRC exclusive patented techniques guarantee precise tolerances and uniform quality . . . offer broad design flexibility. GRC saves, too, by doing it in one high-speed operation . . . no trimming, no assembly, no scrap loss.

That's why the ***BIGGEST PART*** of our business is the LITTLE PART . . . in the product you make.

Write, wire or phone TODAY for these bulletins. Better still send your prints for quotation.

Zinc Alloy in quantities from 100,000 to millions, max. size 1¾", ½ oz. **Plastic** from 25,000 max. size 1¼", .03 oz.

NO SIZE TOO SMALL!

GRIES REPRODUCER CORP.

World's Foremost Producer of Small Die Castings

157 Beechwood Ave., New Rochelle, N. Y. • NEw Rochelle 3-8600

For more information circle No. 32 on the Reader Service Card

For more information circle No. 56 on the Reader Service Card

You save space and weight with the

NEW SELF-LUBRICATING SPLIT THRUST BEARINGS

National split thrust bearings are light, take little space. Assemble them quickly to hold against rotation and high thrust. Eliminate bulky, heavy threaded washer-and-nut or set-screw collar assembly.

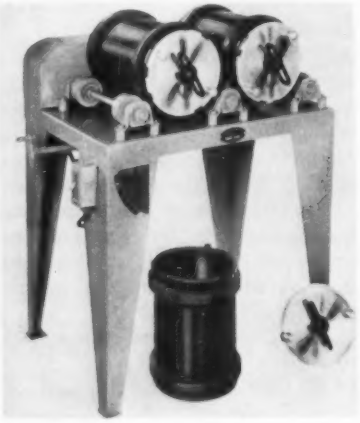
(Patent Applied For)

WRITE TODAY for illustrated folder and data sheet. You'll be amazed at the money you save! National split thrust bearings will be made in standard shaft sizes from .250 to 3.00.

POWDERED METAL PARTS · NATIONAL · MOLDED PRODUCTS INC. · PRECISION ENGINEERED

NATIONAL
MOLDED PRODUCTS, INC.
ST. MARYS, PENNA.

BARREL FINISHING MACHINE
. . . has molded rubber barrel



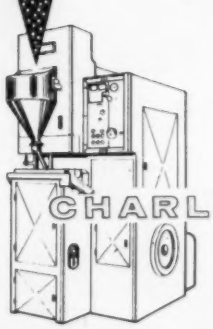
GLOBE BARREL FINISHING EQUIPMENT DIV., CASALBI CO., has developed a new barrel finishing machine that incorporates a one piece pressure molded rubber barrel, driven on rollers. The barrel being in one piece, there are no joints or crevices in which particles of abrasive might wedge. The barrels can be used for all barrel finishing operations.

Circle No. 217 on Reader Service Card

YOUR SINGLE SOURCE FOR ALL METAL POWDERS

in our 43rd year . . . . .

As producers and as sales agents for some of the largest domestic and foreign producers of metal powders, the Hardy Company has contributed to the expansion of the field of uses for metal powders and to the variety of powders available. This is your source for almost every metal or alloy that can be converted to powder, including the newest powders and cermets, as well as all the standard materials.



420 Lexington Ave., New York 17, N.Y.
Telephone: Lexington 2-4224

CHARLES HARDY, INC.

COMPLETE REFERENCE MANUAL ON METAL POWDER RAW MATERIALS NOW AVAILABLE. WRITE FOR YOUR COPY.

For more information circle No. 35 on the Reader Service Card

STROH

DIE CASTINGS for 55 YEARS

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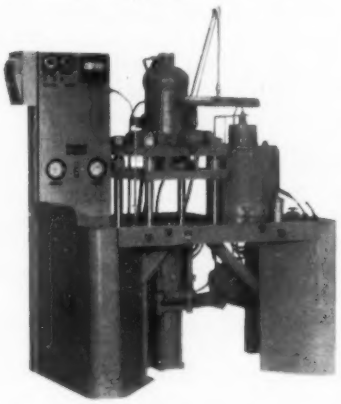
. . . holds temperature to ½°



A new center injection wax machine, built by LEYDEN HYDRAULICS, INC., features better center distribution of wax in the mold for turbine wheels and similar shapes. Completely self-contained, the unit has two hydraulic pumps, one for clamping and one for injection, both are adjustable to deliver clamping pressure up to 20 tons, and injection pressure of 50 psi to 2000 psi.

The wax, wax unit and nozzle of the equipment are heated by forced, circulating oil, temperature controlled by an indicating pyrometric proportioning instrument. The nozzle moves to and retracts from the die seat hydraulically, with each adjustable speed. After each cycle, the wax cylinder is completely purged, automatically.

Measurements are 37″ x 63″ x 74″ high; weight, approximately 2500 lbs. The unit comes complete with a universal movement fluorescent lamp for ample illumination.

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"Mikrocarbide" is a new line of sintered tungsten carbide powders for hard-surfacing, abrasives, diamond settings, and other applications where a hard, wear-resistant material is required.

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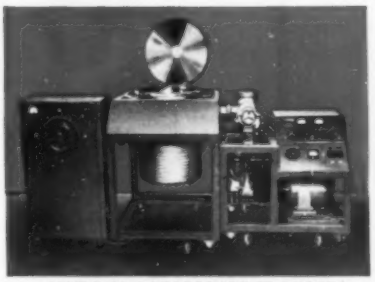

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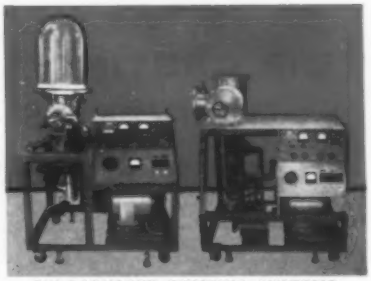
The Kinney F-15 Furnace is designed for high performance, sound economy and maximum flexibility. Temperatures in excess of 2000° C are attainable—ultimate pressures to 1 x 10^{-5} mm Hg. Induction or Resistance Heating for degassing, melting, alloying, sintering, annealing, welding or brazing. Kinney Vacuum Furnaces in production and pilot plant sizes for high purity metals and alloys. Write for Bulletin 807.



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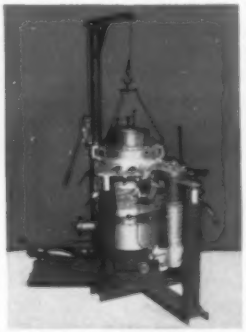

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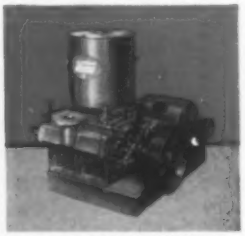

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ZINC

continued from page 57

on producers who are making every effort to curtail production without increasing costs and without closing mines in communities which depend on them for a living.

The only relief, according to Ince, is favorable consideration of the Tariff Commission's recommendations by the president, since congress adjourned without favorable action on the metals' relief bill.

Ince went on to say, "The greatest need is for stability in price at a competitive level, and a steady availability of supply. Under present conditions it is hardly likely that these will be achieved. We in the zinc industry deplore the fact that there is no firm quotation for alloy on which the die caster can price his product."

"Adequate tariff protection together with a pickup in business would correct the situation." He described the tariff question as being in the lap of the "Great White Father" in Washington. As for a business pickup, it appears not too impossible for both the short and long-term pull.

In referring to a business improvement in diecasting, Ince said, "There is every indication that the use of zinc for die castings has definitely turned upward from the ten-year low to which it dropped at the end of the first quarter of this year."

Using the Consumer Durable Goods Index as a reference, he showed that the use of special high-grade zinc, and hence die castings, are directly related to this index (see chart). "This is not surprising," he said, "since approximately 60% of all zinc die castings go to the automotive industry; 15% go to home appliances. The fact that zinc consumption did not decline the same as durable goods might be credited to the lag between raw materials (die castings in this case) and the finished product (durable goods). The graph shows that the use of zinc die castings never went as high or as low as the index.

"For the long pull," he said, "the prospect is even brighter. The weight of castings per car has increased from 43 pounds in 1950, to 64 pounds last year. Buick used

164 pounds per car in 1958 and the increases in other 1958 models will still further increase the average per car."

Ince commented on the research work now underway at Battelle Institute. These projects seek new, improved zinc die casting finishes, newer and stronger alloys and other improvements. There are similar investigations being carried on by the British non-ferrous Metals Research Institute.

SECONDARY ALUMINUM

continued from page 58

lationship will continue through 1959. With scrap as abundant as it is today, the price differential in favor of secondary aluminum will remain.

He warned metal-users, saying, "One of the most important things to consider in any projection of aluminum usage is the type and quality of metal you plan to use. What I have been talking about principally concerns quality-controlled alloys sold by reputable, established smelters."

He added, "Work with the smelters who are familiar with your quality and metallurgical needs, who stand behind their metal and understand the secondary metal industry."

Increasing consumption of aluminum fabricated shapes will continue to provide an increasing supply of new scrap, he predicted.

The use of 2% and 3% maximum 380 zinc alloys is increasing, he told ADCI members. With the high zinc aircraft scrap available, favorable price differential of the 2% and 3% zinc grades to 1% zinc die casting grades will continue, but the price differential may lessen.

Expanded primary production facilities and the abundance of primary aluminum make it doubtful that periods of extremely tight metal-supply and extended demand will re-occur. These caused secondary prices to rise above comparable primary prices, he explained.

"The outlook therefore," he added, "Is that in the foreseeable future, secondary prices are not in danger of being out of line competitively; and for 1959, it appears likely that the favorable price differential now held by secondary 380 in relation to 2393 and primary 380 should continue. With volume increasing through the next four to five months, we see little likelihood of weakness in secondary aluminum ingot."

But Baumann warned: "This scrap supply situation is based on the assumption that there will be no material change in the international situation."

PRIMARY ALUMINUM

continued from page 59

to improve established applications and work out the 'bugs' in new ones."

"Among applications developed in, and for, the automotive industry are engine blocks, cylinder heads, manifolds, pulleys, rocker arms, oil and water pumps, wheels, gear cases and transmission parts in addition to the brake drums. The automobile industry is vitally interested in these developments mainly because aluminum's light weight will help them solve their constantly increasing weight problem."

"Of course," Wilmot said, "your industry has other important markets. Industrial and commercial machine tools and equipment, office equipment machines, recording, indicating and controlling devices and home appliances, furnishings and equipment are a few which show good growth potential."

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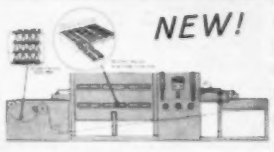

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NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

NEW AMERICAN DIE CASTING INSTITUTE OFFICERS ELECTED AT ANNUAL MEETING IN CHICAGO

SCHNEIER

CURRY

STRASSMAN

DREIBUS

PETERS

KOPPER

The AMERICAN DIE CASTING INSTITUTE, trade association of the custom die casters, have elected new officers for the coming year. The new president and vice president are: Robert C. Strassman, secretary treasurer of Badger Die Casting Corp., president; and Gordon C. Curry, sales manager, Dollin Corp., vice president. Re-elected are: David Laine, secretary; and W. J. Parker, treasurer.

In addition, the four ADCI regional groups elected these chairmen: Eastern Regional Group, Alfred Schneier, Jr., vice pres. Advance Pressure Castings, Inc.; Central Regional Group, Robert I. Kopper, executive assistant, Monarch Aluminum Mfg. Co.; Midwestern Regional Group, R. A. Peters, New Products Corp.; and the Pacific Coast Regional Group, R. R. Dreibus, president, Harvill Corp.

In addition, new members of the board of directors were elected for the coming year.

ANNUAL ADCI MEETING IN CHICAGO

The AMERICAN DIE CASTING INSTITUTE, trade association of the custom die casters met in Chicago at the Edgewater Beach Hotel on September 9, 10, and 11. The tenor of the meeting was on production efficiency and technical advances in the industry.

The Institute has in operation a highly active research program. Part of the program is entirely ADCI sponsored and part is in cooperation with the American Zinc Institute.

Among the many problems under investigation are improved die and core steels, die lubricants, new processes and production control apparatus, vacuum die casting, and basic research. Work on alloy development is in cooperation with the AZI.

Another phase of research being actively investigated is: Causes and correction of heat checking of dies. Reports are encouraging on this work and, it is hoped, will eventually lead to the economic die casting of high melting point alloys. Brass die casting seems certain of solution and possibly the die casting of the ferrous metals.

NEW PURCHASING DIRECTOR FOR ALLOYS & CHEMICALS

Alfred S. Dubinsky has been appointed director of purchases of ALLOYS & CHEMICALS MFG. CO., INC. According to N. L. Butkin, president of the company, the new purchasing director will be responsible for the purchase of all scrap and related products.

CASTING SUPPLY HOUSE APPOINTS SALES ENGINEER

John S. Palazzo, formerly of National Precision Casting Corp. has joined CASTING SUPPLY HOUSE as sales engineer, according to Robert Greenbaum, president of Casting Supply.

Mr. Palazzo studied metallurgy at Temple University.

DOEHLER AWARD FOR 1958

NYSELIUS

Each year the AMERICAN DIE CASTING INSTITUTE presents the Doehler Award to some individual in, or associated with, the die casting industry. The award is in recognition of outstanding contributions to the industry.

This year the Doehler award goes to Gustav Nyselius, president, Mt. Vernon Die Casting Corp. In presenting the award, Austin T. Lillegren, vice president, Madison-

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Kipp Corp., cited the work of Nyselius in initiating the concept of advancing die casting techniques by cooperative efforts and the pooling of patentable developments through the Die Casting Research Foundation.

HENRY HAUSNER JOINS HARDY, INC.

CHARLES HARDY, INC., has announced the appointment of Dr. Henry H. Hausner as Scientific Advisor to the company on powder metallurgy development. Internationally known for his work on powder metallurgy and on nuclear reactor components, Dr. Hausner is Adjunct Professor of Metallurgy at the Polytechnic Institute of Brooklyn, is active as a consultant on nuclear engineering problems in this and foreign countries and works under contract with the Atomic Energy Commission on studies of powder metallurgy materials and processing. This appointment is expected to contribute to the advancement of numerous new metal powder raw materials under current development by the company.

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Outstanding features include — all steel welded construction — automatic electric cycling at high speed — 17¾ x 17¾" die platens — 6½" die stroke — highest grade controls and valves mounted for easy maintenance and accessability — a complete package with self contained unit.

Available in Air or Hydraulically operated plunger gooseneck type for zinc, tin or lead, or, cold chamber type for aluminum, brass and magnesium.

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Newton-New Haven
and others

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THEY'LL BE HUNTING for die casting sources in

PMM's DIE CASTING DIRECTORY for JANUARY, 1959

Everyone interested in die castings will read PMM's January issue. Buyers and producers of castings alike will keep this issue for year-long reference. Put your ad in the Die Casting Directory issue to sell die castings, dies, metals, equipment or materials.

RESERVE SPACE NOW.
Forms close December 1.

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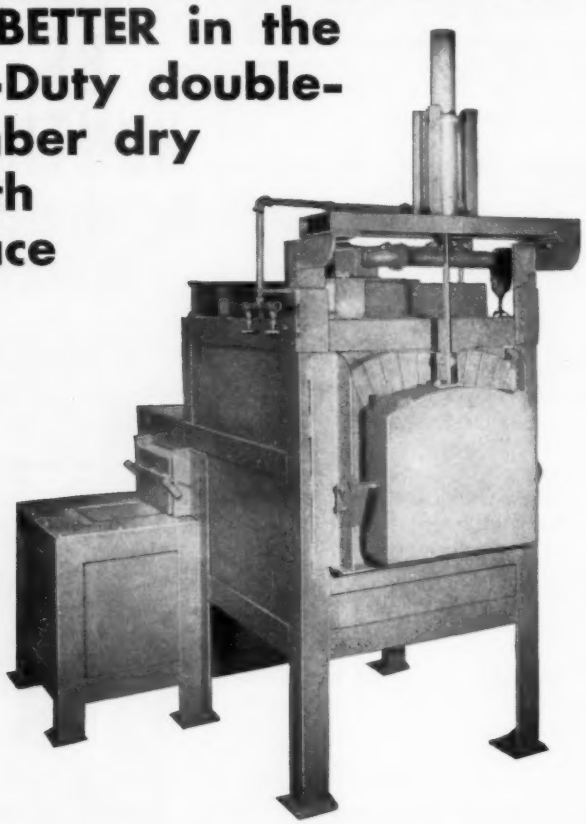
Aluminum is melted FASTER and BETTER in the Hevi-Duty double-chamber dry hearth furnace



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Moisture evaporates and is carried off during melting. All oxides are deposited on hearth surface, none are carried into the bath. Lack of need for bath agitation eliminates gas inclusions. Direct firing also saves fuel costs and provides more comfortable working temperatures around the furnace. See it at the metal show, Booth 241.

Write for Bulletin C-80 for complete details.

- Industrial Furnaces Electric or Fuel
- Dry Type Transformers
- Constant Current Regulators

HEVI DUTY ELECTRIC CO.
Milwaukee 1, Wisconsin

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PMM OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding. 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

EQUIPMENT

1 Lester-Phoenix HHP3XS, 600 ton cold chamber die casting machine. Would consider small zinc machine as trade-in. Reply to: Dixie Die Casting Corp., Box 1208, Reidsville, N. C.

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Die caster wanted; aluminum or zinc functional parts and/or decorative trim facilities; manufacturer's sales agency with excellent coverage of major appliance companies southern Ohio, southern Indiana, Kentucky and Tennessee; need quality manufacturer to represent on commission basis; forward replies to: Holland Agency, 2530 Auburn Avenue, Cincinnati 19, Ohio.

PLANT SUPERINTENDENT

Established smelter entering aluminum field seeks plant superintendent for secondary aluminum alloy ingots. Good opportunity. Write stating qualifications. Box No. 10158, Precision Metal Molding.

NEW INVESTMENT CASTING STANDARDS READY

Two new standards for investment cast metals are now available. The new specifications are FE-3 for Cast Nickel-Chromium Stainless Steel and CU-2 for investment cast Beryllium Copper.

Nine standards for investment cast metal are now available. They can be purchased from the INVESTMENT CASTING INSTITUTE, 27 E. Monroe St., Chicago 3, Ill.

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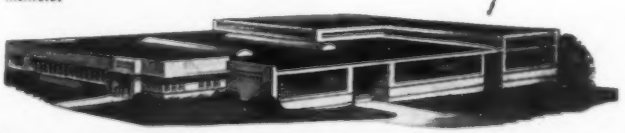

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Established 1909

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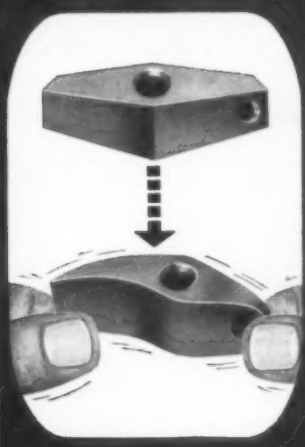
just to *stretch* a point.



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Remet Powdered Metal Part cuts DESIGN and MACHINING costs for Bonney Forge and Tool Works

R. L. Huston, Chief Engineer for Bonney, says, "We went to a powdered metal part on our shifter because the cost of machining this part from steel would have been prohibitive. Also, we would have had to change the entire design of our ratchet. We contacted no less than a dozen fabricators of powdered metal. Reese Metal Products Corp. was the only establishment able or interested in tackling this problem with us."

Bonney now uses Remet shifters in seven of their ratchets. The sintered Remet parts are copper infiltrated iron.

More and more design and production men each year rely on Remet services to help solve problems.

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